POPULAR MECHANICS

DRILLING AND THREAD CUTTING HANDBOOK

POPULAR MECHANICS PRESS
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Drilling and Thread Cutting Handbook No. 1

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WARNING

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DRILLING
AND
THREAD CUTTING

A compilation of 301 experiences in the drilling of metal and
the cutting of threads, showing not only how to
use drills, and taps and dies, but how to
make devices for special requirements
in this work.

WITH 298 ILLUSTRATIONS

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FOREWORD

ALMOST everyone has need for ideas on drilling and thread cutting. Even the office man who does not handle tools in his business, has many opportunities to save himself expense and add to his pleasure by using tools about his home.

This book is made up of 301 experiences of men who have discovered ways to use drills, drill presses, taps, and dies with more effectiveness. Many unusual jobs have been accomplished with these tools by those who have contributed to this book, and they tell just how these jobs have been done so that you may duplicate the performance.

One business authority has declared that the greatest advance in business in recent years has been the willingness of business men to exchange ideas. This book is a medium of exchange for all those interested in working metal. There is no theory, no "wild scheme" in this book. It is made up entirely of practical, tested plans.

HOW TO USE THIS BOOK

For your convenience, the articles are arranged under nine headings. Thus, when you look for one article, you will find many others on the same subject, and you may thus find a better plan than if the articles were placed without any order.

You may save yourself much time if you will refer to the index whenever you want help. Just look for the word that represents the work you wish to do or the tool you wish to use. For example, if you need a gauge, you will find 13 articles listed under the word "gauge." Among these, you will probably find, not only the kind of gauge you want, but one or two others that interest you.

It will pay you to look through the index frequently. It is short, and easy to read. By reading it now and then, you will familiarize yourself with what the book contains and will also discover many ideas that may be of immediate value to you.

No book is of value to you unless you use it. You are not likely to use it unless you know what it contains. It is important, therefore, to keep yourself familiar with the contents of this book.

You will find the illustrations particularly valuable. They have been drawn by experienced artists who know what you need in duplicating an idea. The drawings are clear, accurate, and simple. In many cases, you can make the device by examining the drawing only.

How the 301 Ideas are Arranged in This Book for Your Convenience

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SPECIAL METHODS FOR HANDLING DRILLING AND BORING JOBS
58 articles, beginning on page 1

SPECIAL TOOLS AND DEVICES FOR DRILLING
75 articles, beginning on page 15

HOW TO MAKE DRILL BITS AND BORING BARS
31 articles, beginning on page 37

IDEAS ON DRILL PRESSES
23 articles, beginning on page 45

SPECIAL METHODS OF REAMING AND BROACHING
22 articles, beginning on page 55

METHODS AND DEVICES FOR THREAD CUTTING
18 articles, beginning on page 61

TAPS AND HOW TO HANDLE THEM
15 articles, beginning on page 67

DIES AND HOW TO HANDLE THEM
16 articles, beginning on page 71

UNUSUAL DRILLING AND THREAD CUTTING JOBS
43 articles, beginning on page 75

A complete index of all articles begins on page 85. Refer to it whenever you have a drilling or thread cutting job to do.

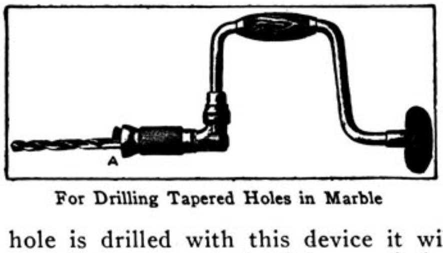
Special Methods for Handling Drilling and Boring Jobs

Boring Large Holes in Glass

Take a piece of brass tube, about 1½ in. long, and the diameter of the hole to be made, and file small teeth in one end. Make a shank which will fit a drill-press chuck, or use a discarded drill shank. Taper one end slightly to fit into the brass tube about ¾ in. Small holes may be bored in the tube just below the end of the shank for the purpose of lubrication. Use a mixture of gum camphor and turpentine for a lubricant, to which is added a little emery flour to make a thin paste. The speed and feed of the drill must not be sufficient to develop heat, as this may crack the glass. This is a process of wearing rather than of cutting. When the upper hard skin of the glass is cut, the drilling will progress rather easily until the lower glass skin is reached. To prevent cracking when the drill goes through, drill a small hole through the lower skin, and then ream out to size. The same method may be used to cut glass along straight lines, by using a copper or brass disk with small teeth on the outer edge, and rotating in a lathe or milling machine.—J. Garrett Kemp.

How to Drill Tapered Holes in Marble Slabs

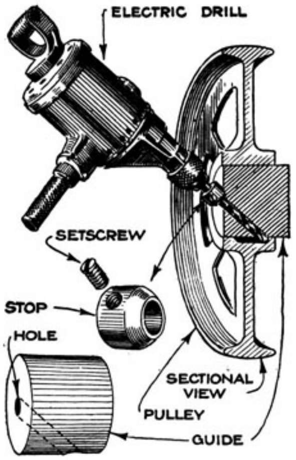
Sometimes the plumber needs to drill holes in slate and marble slabs in which to insert wood plugs for holding retaining screws. When a straight hole is drilled the wood plug is liable to shrink and slip out, even though it may be well fitted and driven in tight. Tapered holes are necessary. These holes may be drilled in one operation by removing one jaw from the chuck on the brace as shown at A in the sketch. This will set the point of the drill a trifle to one side of the center line. When a hole is drilled with this device it will have sufficient taper to hold the wood plug tightly.



For Drilling Tapered Holes in Marble

Cutting Oil Grooves in Pulleys

The drilling of an oil groove in the bearing of a loose pulley, or similar part, is a simple operation when a loose-fitted drill guide, of the type illustrated, is used. The guide consists of a piece of round bar stock, of approximately the same diameter as the hole in the pulley, with a diagonal hole extending from the center through the side. A stop, to be clamped to the drill, has one edge beveled off to correspond with the angle of the hole in the guide, against which it bears. As the drill is fed forward, the bearing metal is cut away to form a V-bottomed groove. As the guide is free to move in any but a perpendicular direction, variations of the operation described make it possible to cut grooves in a variety of patterns.



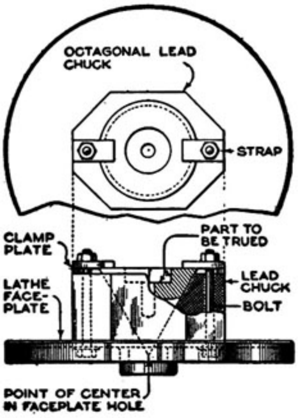
Uses for Left-Hand Drills

No doubt many mechanics have never heard of left-hand drills and would regard them as a joke, yet they are a useful thing in many shops. These drills have their flutes cut in the opposite direction to the ordinary, and to cut they must, therefore, be turned in the opposite or left-hand direction. They may be obtained from any drill manufacturer at practically the same price as the ordinary drill.

They are useful when, for some reason or other, a regular drill "digs" in or sticks in the cut. A common example is the drilling out of a hole that has threads in it. The points of a regular drill would catch in the threads and make a slow and poor job. A left-hand drill will cut over the angle of the threads, not into them, and do it easily and quickly.

Boring Out Pipe-Center Base in Lead Chuck

A pipe center that required boring out to take a new thrust bearing offered a rather difficult problem, as its shape made it hard to hold it true for machining in the lathe. To accomplish this, a lead chuck was made, the center clamped in it, and the whole bolted to the faceplate. A roughly octagonal mold was built of wood, a little larger inside than the outer diameter of the center. This was placed on a flat, level board, the center placed within it, base down, and two bolts were driven into holes bored in the board to receive them. The top of the mold was finished level, so that when filled with lead both faces of the chuck would be approximately parallel and square with the center. A smooth board, with a hole for pouring and a small vent hole, was clamped over the top of the mold, with the point of the pipe center and the two bolts projecting, and the mold poured full of lead.



When cool, the mold was removed, the pipe center driven out, and the chuck bolted to the faceplate and trued up as nearly as possible. Then a light cut was taken along the side of the cavity, using the compound rest, at the same angle as the face of the pipe center, until the center, when placed therein, was found to run true. It was then clamped in place by a couple of short straps, and the boring continued, taking light cuts so as not to throw the chuck out of true. The point of the center projected through the chuck and into the center hole of the faceplate.

Taper-Shank Drills Used in a Chuck

In the machine shop of a felt mill several miles from town only straight-shank drills were used, because they were easily obtained in the small town. One day the errand boy brought back six taper-shank drills, and some of them had to be used immediately.

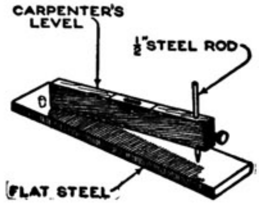
The one lathe in the shop was a small affair with a solid tailstock, and we had no way of boring a taper hole, but as there was no time to send the drills back for exchange, we made sockets interchanging with the straight shanks in the following manner: Copper wire was wrapped around the drill shank, that had been previously rubbed with black lead, one layer deep, the size being about that of ordinary wire used for baling hay. The wire was tied with fine wire, to hold it in place, and then dipped in soldering solution.

A straight hole was bored through a block of wood, the wrapped drill shank placed centrally in the hole, tang down, and the lower end was packed with clay, whereupon melted hard solder was poured in around the drill shank. When cool, the shank and its copper-and-solder socket was removed from the mold by splitting the wood.

A hole was then drilled through the side of the socket and part way into the drill shank, to make a good countersink, and the hole threaded. A setscrew was used in the hole to clamp the drill in the socket. The whole collet was then turned up in the lathe. No attempt was made to drive the drills by the shanks; they were driven with the setscrew.—J. B. Murphy, Plainfield, N. J.

Leveling Work to Be Drilled at an Angle

When a piece of flat metal work must be held at an angle on the drill-press table, so that an oblique hole can be drilled, it is not always an easy matter to obtain this angle accurately. A common carpenter's level, fitted with a steel pin as illustrated, will simplify this problem. A piece of ½-in. steel rod is run through one end of the level, and provided with a setscrew to tighten it in any position. The distance from the center of this pin to the farther end of the level should be some round number of inches, such as 10, 15, or 20. The lower end of the pin is filed or turned down to a fairly sharp point, which should be exactly centered.



If the work is to be drilled at an angle, for instance, of 10°, and the distance from steel point to farthest end of level is 20 in., the level is set as follows: From a handbook, the tangent of 10° is found to be .1763. Twenty inches multiplied by the

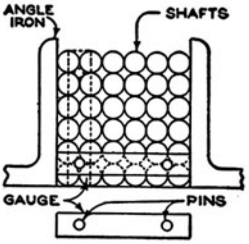
.1763 gives 3.526 in., which is the distance the point of the pin must come below the bottom of the level. When the pin is fastened in this position, and the work clamped to the drill-press table, the level can be placed on the work, and will show immediately whether the angle at which the work is set is the correct one. If not, adjustments are readily made.

Drilling Deep Holes

When drilling deep holes with a twist drill the cutting edge should be ground so that the point will be a little out of center. This will make one cutting edge longer than the other, thus causing the drill to make a trifle larger hole. This gives clearance to the drill.

Marking Off Centers on Shafts

When large numbers of short lengths of round stock require to be marked off at the ends, preparatory to center drilling, much time can be saved by the simple set-up shown in the drawing, together with a special marking-off gauge.



Arrange the shafts, after cutting to the proper length, in layers six wide and six deep, between two angle plates bolted down to a drill-press table, or other plane surface. The gauge can be made from any flat stock, but its width must be the exact diameter of the shafts. A pin is driven into each end of the gauge, their diameter being such as to make them a snug fit into the spaces formed by the junction of four shafts. The distance apart of these pins is the same distance as the first and last spaces in the rows of stock.

When marking off, place the gauge in a horizontal position, with the pins in the spaces, as indicated in the drawing, and scribe a line along the shafts; this will give the center in one direction. After the lot has been scribed horizontally the gauge is placed in a vertical position and lines are scribed perpendicularly, the intersections of the horizontal and perpendicular lines being the centers of the shafts.

❡A metal surface polished with oil will keep clean longer than when polished dry.

Boring Oval Holes

Lay out and cut to shape a form or guide, A, Fig. 1, of machine steel, as required and fasten it to the work to be bored or turned. The boring bar (Fig. 2) has the usual cutter, B, fastened with the setscrew D. A collar, H, is made a sliding fit for the bar. Drill the guide and work for cap screws and place parallels, FFF, Fig. 3, between the guide, work M, and faceplate P, for clearance. The boring bar collar H is held against the guide plate by attaching a weight to a chain, K, which is fastened to the tool-post feed after removing the screw.

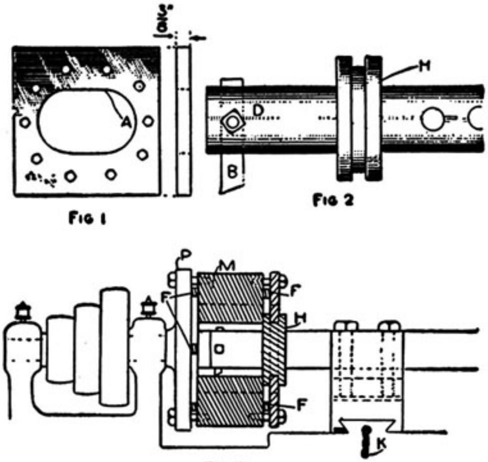


Fig 1 Fig 2 Fig 3

Shape and Position of the Guide Form

The guide plates can be made in various shapes for making cams, cylinder, jig, and experimental work.—J. B. Roberts, Everett, Mass.

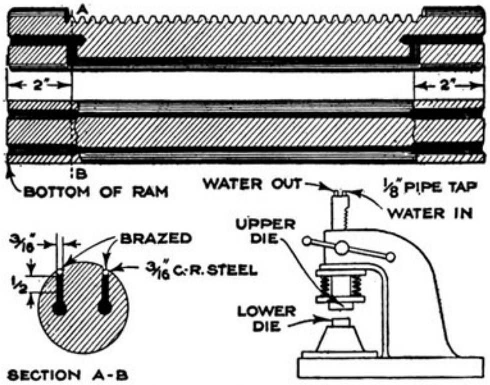
Soap as a Lubricant for Drilling

A bar of common laundry soap makes a good lubricant for the drill when cutting holes in fibrous materials, such as red or black fiber, and similar substances. The soap is held against the drill point occasionally, and prevents the chips from packing around the drill, which would cause heating and binding. With soap as a lubricant, the chips feed readily up the flutes of the drill, regardless of the depth of the hole. The same lubricant can be used when tapping.

❡Be sure to keep the screw and nut in the jaws of a drill chuck clean and well oiled, to prevent broken screws.

"Drilling" Deep Holes

A small machine shop undertook a simple job of die casting, and prepared to use a small arbor press for the job. It was necessary to water-cool the dies, and, as with the type of die employed it was necessary to introduce the cooling water for the upper die through the ram, it was at first thought necessary to drill the ram from end to end, a job beyond the facilities at hand.



A Method of Machining Deep Holes Where Proper Drilling Facilities Are Not Available

The work was eventually done as illustrated. Two holes of the proper size were drilled in each end of the ram for a short distance; these were intersected by other holes drilled from the ram surface. Two 3/16-in. slots, 11/16 in. deep, were then milled along the ram, connecting the end holes, and two pieces of 3/16-in. cold-rolled steel were brazed into the slots as shown, thus leaving a 3/16 by ½-in. passage for the water. The outer surface of the ram was then filed round and polished, completing the job.

Reducing the Size of a Drilled Hole

When a hole has been drilled too large in a piece of iron or steel a good method of reducing the diameter to the proper size, provided the difference is not too great, is to heat the piece red hot, then by taking care to keep the axis of the hole perpendicular to the surface of the water, submerge the piece half way. The lower half will become cold and shrink and the upper part, which is not in the water, will remain red hot and shrink to a certain extent as it cools, being pulled together by the chilled part. When the top part finally cools, that side will shrink more, making one-half of hole smaller than the original size. Heat the piece red hot again and repeat the operation, but this time cool the opposite side of the piece in water. This is a practical scheme and will reduce holes in metal to a surprising degree.—H. D. Chapman, Washington, D. C.

Sizing a Threaded Hole

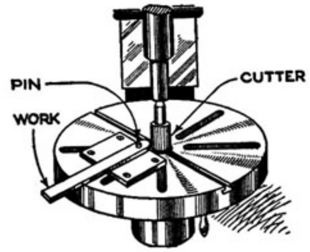
It sometimes becomes necessary to transfer the size of a threaded hole from some out-of-the-way place to the shop in order to make a piece to fit it. With proper tools this is easy; without them, it might be difficult. One thing is always at hand and that is wood. Whittle a stick tapering until it starts in the hole. Then turn it into the hole and a fair thread will be made on the wood. The stick can be carried in the pocket without risk of changing the size, as would be the case with ordinary calipers.

How to Use an Expansive Bit

I was boring a 1½-in. hole with an expansive bit in a dry, hard maple timber, and it took a good deal of muscle to keep the bit turning, says a correspondent. A carpenter passed and advised me to turn the cutter of the bit in the same direction as the handle of the brace, and stand with the grain or length of the stick. The result was it lightened the strain of the cutting a good deal and taught me something new. The hardest part of the cut, across the grain, is made while you have the greatest leverage on the brace.

Cutting a Radius on the Drill Press

A quick method of forming a radius on the ends of flat links, where there is much of this work to be done, is shown in the illustration. A milling cutter is mounted on an arbor in the drill press, the end of the arbor fitting the center hole in the table for additional stiffness. A flat plate, fitted with a pin to fit the holes in the links, is attached by means of flat-head screws to the table, at the proper distance from the cutter to give the required radius. The cutter is revolved at a high speed, a link dropped over the pin and swung around in a half circle against the cutter.

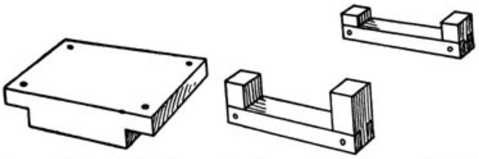


Care must be taken to turn the link so

that the end on which the radius is being cut moves in the opposite direction to the cutter, that is, against the teeth.—Harry Moore, Montreal, Can.

Drilling Slanting Holes in Metal

A quantity of castings, shaped as shown in the sketch, required a hole in each corner to slant at an angle of about 15° to the sides. It is readily seen that a different setting is required for drilling each hole. The tops of the holes slanted inward and imaginary continued center lines would meet at a point about 8 ft. above the piece. To save the setting for each hole to be drilled, two supports were made as shown with end pieces attached, each one of a different length, which gave the proper slant to the piece for drilling the hole. By shifting the casting all the holes could be drilled at the same slant without any special setting.—Donald A. Hampson, Middletown, N. Y.



Supports for Holding a Casting at the Proper Angle for Drilling Slanting Holes at Each Corner

Drilling with Small Drills

A small drill is very apt to break off while being used, especially in a breast drill. I remedy this trouble by having two drills of each size, one of which I break off, saving some of the twisted portion of the bit and grinding a point on it. This is used exclusively for drilling through thin metals, and for starting holes in thicker metals.

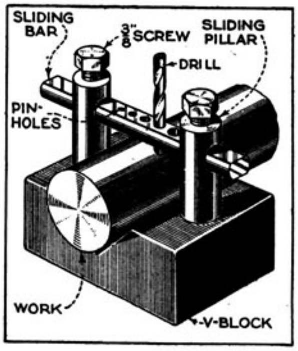
Small drills also break easily when applying too much feed, but a short drill will stand more pressure. The full-length drill is substituted when the hole is drilled as deep as the short one will cut.

The center web of a drill being thicker back of the point, a drill broken off and then sharpened will not cut quite so easily or quickly as the point of a new full-length drill, but in cutting with a short drill, the elimination of that fear of its breaking will more than make up for the extra time spent.—C. W. Goddard, Bellaire, Mich.

¶For a first coat on wood, wood turpentine should be used as a thinner.

Transferring Pinholes in Shafts

Trouble is often experienced with pinholes in worn shafts that are being replaced. Generally, only the shaft is sent to the repairman, with instructions to make an exact duplicate, which is easy enough so far as the diameter and length of the shaft are concerned, but, should the shaft carry collars or flanges pinned to it, a mistake is easily made, as pinholes are as likely as not to be off center. Unless the hole in the shaft matches up with the hole already drilled in the collar, or other part to be pinned to it, the pin will not enter unless it is filed away or otherwise fitted, the result invariably being an unsatisfactory job.



The special V-block shown in the drawing is very handy in cases of this kind, as it enables the operator to reproduce the exact position of the pinholes at once. On each side of the "V" a ¾-in. hole is drilled to take two pieces of cold-rolled steel, these pieces in turn being drilled through for a piece of ½-in. tool steel. This forms a sliding bar that is flattened on the top and bottom and drilled, as shown, for standard-size pins.

The method used in transferring holes is as follows: Place the old shaft in the V-block, the other end being supported by another V-block, or by packing; then, with the sliding bar loose, insert the drill required in the chuck, and bring it down through the corresponding hole in the bar and through the pinhole in the shaft. Tighten the screws provided for clamping the sliding bar, which is now lined up exactly with the pinhole in the old shaft; the latter is removed, and the new one put in place, clamped down, and drilled. The uprights are not clamped in any way, but are pushed down until the sliding bar touches the shaft.

¶To drill chilled cast iron, first draw the chill, by laying the piece on a slow fire in the forge, covering the spot to be drilled with sulphur, and keeping the heat going slowly until the sulphur is burned off; then proceed with the drilling.

How to Drill a Curved Hole

To drill a hole with a curve in it might not be considered possible with ordinary tools and hand processes, yet, like many other things which appear difficult at first glance, it is easy to do. First make a bend in the piece in the opposite direction from the bend which is desired in the hole. This is shown in Fig. 1. Then drill a hole straight through with an ordinary drill, as in Fig. 2. It remains only to heat the piece of metal again and bend it back to its original shape, as shown in Fig. 3, and the hole will then be curved. The metal, if finished nicely, will offer no evidence as to how the curved hole was made.

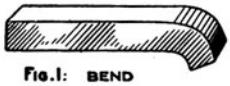


FIG. 1: BEND

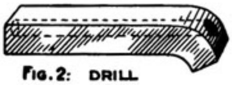


FIG. 2: DRILL

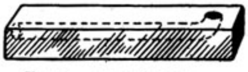


FIG. 3: STRAIGHTEN

To Prevent Drill from Catching as It Passes through Metal

The regular slope of a drill will cause the cutting edge to catch as it breaks through the metal on the opposite side of the piece being drilled. But if a twist drill is ground more flat like a flat drill, it will not "grab" into the metal as it passes through.—James H. Beebee, Rochester, New York.

Drilling Holes Half in Cast Iron and Half in Steel

Anyone who has tried to drill holes half in cast iron and half in steel knows how difficult it is to keep the hole exactly divided between the two metals. A case of this kind is where a cast-iron wheel is held on the end of a shaft with a round key. Cast iron being much less dense than steel, and containing numerous small holes, induces a drill, no matter how well started, to follow the law of least resistance, and if the hole is deep enough it will surely end up entirely in the cast iron. A good way to overcome this is to chip, file or plane in the steel piece a slot as long as the length of the hole to be drilled. In size make it about one-third the area of the final half hole in the steel. Then assemble the two pieces and start the hole half and half, and you will end up with a very nearly straight hole. This slot, which reduces the amount of steel to be removed by the drill, offsets, or rather balances the lighter structure of the cast iron and has this effect for the whole depth of the hole. —D. Hampson, Middletown, N. Y.

To Tighten Loose Nuts

After tapping out a nut for a shaft or bolt, it will sometimes be found that it is a trifle too large, when a tight fit is demanded. To overcome this trouble, and avert the necessity of making a new nut, heat it, and drop it into cold water. This treatment will usually shrink the nut enough to make a tight fit; if the nut is still too large, the operation may be repeated.—L. E. Brundage, Norwood, Colo.

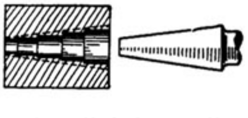
Drilling Holes in Lead

At one time I had to drill 1/8-in. holes in a large number of lead pieces. At first glance this appeared to be a snap—nice, soft metal, etc., but that very softness proved the undoing of the snap. The holes were 1/2 in. deep and before half that depth was reached, a ragged burr of considerable size was thrown up around the top, the hole would be worn out of shape by the "crawling" of the chips, and the drill clogged and stuck repeatedly. I tried water drilling compounds, kerosene, drilling without lubricant, but to no avail.

A good grade of lard oil, and plenty of it, was used as a last resort, and the holes were drilled through straight and smooth, without any burr except the usual small one on the underside. With the oil, it was necessary to lift the drill out at least once to clean up the chip. A drill speed of 800 to 900 r.p.m. was found to give good results.—Donald A. Hampson, Middletown, N. Y.

How to Bore a Taper Hole in Metal

To bore a taper hole in a piece held in a lathe chuck, where neither a taper attachment nor a compound rest is supplied, is a task requiring no little skill. However, the work may be made easier as follows: First drill a hole through the metal of a size slightly smaller than the small end of the desired taper, then by successive steps drill larger holes (always a little smaller than the finished size) until the piece takes the appearance shown in the cross section. A plug should



then be turned, having the same end diameter as the hole to be bored and the same degree of taper. By trying it in the drilled hole, the high spots can be easily detected and taken off with a bottoming tool. This is continued until the hole is cut to the desired taper, but a little small and with its surface rough. Finish with a hand scraper, checking and fitting with the aid of red lead or Prussian blue. A very accurate job can be done in this way. A boring tool with a long, straight cutting edge is good to use in place of the hand tool, but it must be used with care and only a short length taken at a time.

Removing Chatter Marks in a Countersink

In spite of all care a countersink will sometimes chatter or tear, and this spoils the appearance of a job. To remove the chatter marks, place a small piece of emery cloth, with the abrasive side downward, over the hole, and bring the countersink down. In a few minutes, all the chatter marks will be polished off.

Drilling Holes Larger at the Bottom

A mechanic often has to drill a hole, which, when completed, should be larger at the bottom than at the top. This may be accomplished by grinding the center or point of the drill off to one side as shown in Fig. 1. The drill can then strike a larger radius or diameter than that of a drill being used as in Fig. 2. In Fig. 3 one form of hole is shown which can be made by this method.—Geo. W. Richardson, Chicago, Ill.

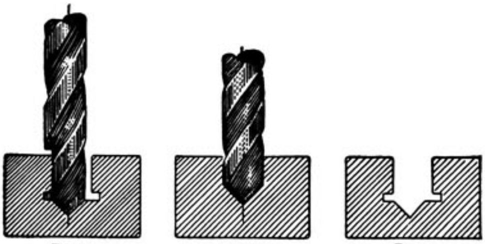
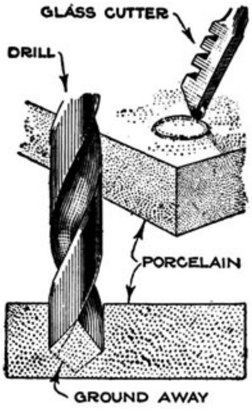


Fig. 1 Fig. 2 Fig. 3

Hole Drilled Larger at the Bottom

¶An ordinary twist drill can be made to drill a hole larger than its diameter, by grinding one of the lips a trifle longer than the other. This is especially desirable when a slightly oversize drill is wanted.

Drilling Holes in Porcelain



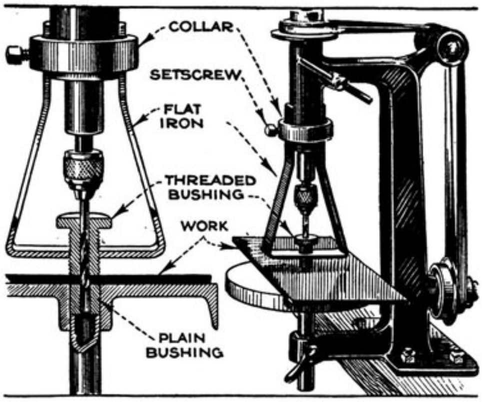
The mechanic who undertakes to drill holes through porcelain bathroom fittings, and other expensive equipment of the same material, is quite likely to break the article unless considerable care is used. Although brittle and hard, glazed porcelain can be drilled easily if properly handled. The main difficulty lies in getting the drill properly sharpened; the proper way is to grind the point of the drill perfectly square and then, holding it on one edge of the wheel, to grind the cutting edges as shown in the drawing. To start the drill through the vitreous glaze, cut a circle, the same diameter as the hole, at the proper location, with a glass cutter, the cut being carried through the glaze; the drill will then enter easily. As soon as the drill stops cutting take it out and carefully chip off the triangular peak in the center of the hole with a narrow chisel, nailset, or similar tool. This operation is repeated until the hole has been drilled through.—W. Norman Fox, Atlantic City, New Jersey.

Drilling Fiber

A small shop order called for the drilling of a large number of soft fiber sheets. The holes were laid off and prick-punched in the usual way, but trouble arose during the drilling in that a ragged burr was formed on both sides of the holes and attempts to remove it merely resulted in a much worse looking hole.

To overcome the trouble, a fixture of the kind illustrated was attached to the drill press. It consists of a piece of flat iron, a collar, and two bushings, one threaded and the other plain. The plain bushing is a tight fit in the hole in the center of the drill-press table, and the threaded bushing screws into a tapped hole in the flat iron, which is bent to the shape shown, and clamped to the drill-press spindle by a collar and setscrew. Thus the entire surface of the table is clear of any obstruction and the work can be moved around as freely as if no fixture were used.

In operation, the flat-iron bracket is held about 1 in. above the surface of the work;



Fixture on the Drill Press for Drilling Holes through Soft Fiber without Burrs

then with the drill revolving in the hole of the threaded bushing, the spindle is brought down until the drill point enters the punch mark. The threaded bushing is then screwed down tightly on the work and the hole is drilled. With the work thus held tightly between the two bushings, a clean-cut hole can be drilled. The threaded bushing is turned back only a couple of threads when changing the position of the work—just enough to allow the operator to see when the drill point enters the punch mark, so that operation of the device does not by any means slow up the work.

Drilling Large Holes with a Small Bit

Some 9-in. holes had to be drilled for steel anchor posts for a railroad company along the lakes and the contractor had 5-in. bits, only. He did not care to change his bits to 9 in. in order to make the few holes. The holes were to be 23 ft. deep—15 ft. in dirt and 8 ft. in bed rock of massive bedded shale. A 12-in. hole was dug with a spade to the depth of 1½ ft. Owing to the play the tools had above it, it was easy to spud the sides of the hole down nearly straight, but as the anchor posts had to fit pretty snug in the shale, the hole was tapered from the top so that when the shale was reached the hole was reduced to 10 in. The hole was started in the shale at 10 in. and the swinging of the top of the tools in the 12-in. opening enabled the operators to carry the hole down at a diameter between 9 and 10 in.

It was found necessary to keep perfectly square corners on the bits and to keep the top of the tools moving so that the bit cut full size of the hole.

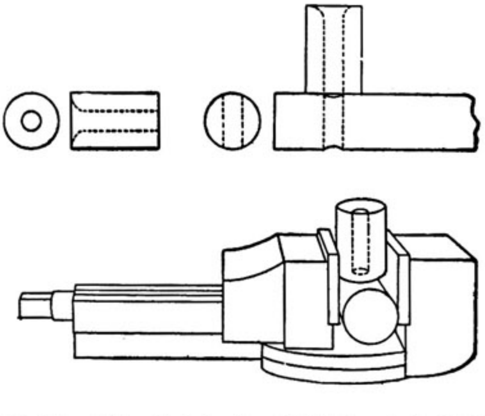
In drilling the holes 4 ft. of lake sand was struck which was mixed with water sufficient to make it run like quicksand. Some good stiff clay was procured and chopped up fine and dumped in the hole, with the addition of enough water to make a nice thick batter. By keeping the batter at the right thickness the tools were put in and no trouble was encountered in reaching bed rock. The only thing that had to be guarded against was to keep from getting too much water in the hole at one time, as an excess of water washed the clay from the sides of the hole and let the sand run.

Drilling a Hole in the Joint of Two Pieces

Put the pieces to be drilled, one at a time, into the shaper and with a V-shaped tool just mark the work along the centerline the drill is to follow. When the work is put together, there is a very small hole for the center of the drill to follow. By using a small drill first, to widen out the hole, other drills can be easily held in their course.

Drilling Holes Straight through Diameter of Shaft

It is impossible to drill a hole in a round shaft accurately unless some sort of a jig is used. One of the best and least expensive methods for this work is to make a collet of the same outside diameter as the shaft to be drilled, and bore a perfectly central hole through it the size of the drill



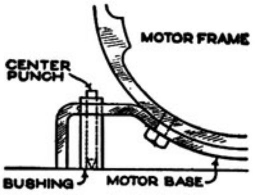
The Vise Grips Both Stock and Collet, and the Drill Must Enter Straight used in drilling the hole through the shaft. The shaft is placed in a vise and the collet set on top of it, as shown in the illustration, and both are clamped together. The drill is then run through the collet hole, which guides it for drilling the hole in the round stock.—G. T. Du Bois, Detroit, Mich.

To Use a Bent Drill

When a drill wabbles as it turns with a chuck, either the drill is bent or the chuck jaws are not true. With the point of the drill moving in a circle, it is difficult to start it in a center-punch mark. A method of doing this, is to stop the machine and bring the point of the drill down in the punch mark and hold it there with the lever while the machine is started. The spring of the drill and machine spindle allow the point to enter the punch mark straight. The proper thing to do would be to correct any existing error, but time and other conditions sometimes prevent the making of the repairs.

Locating Bolt Holes Where Scriber Cannot Be Used

Where a bolt must pass through two pieces of metal separated by an air space, it is often difficult to mark the location of one hole from the other. In the case illustrated, where the base of a motor was to be bolted down, the mechanic, finding it impossible to use a scriber or a center punch in the ordinary way, turned up a bushing and used a small center punch made of drill rod to locate the center of the hole.—Joe W. Romig, Allentown, Pa.



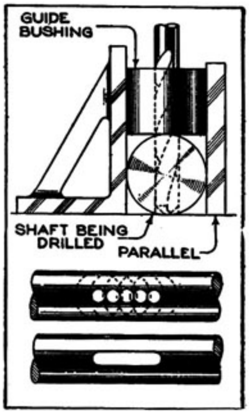
Drilling Dies

Die makers should space off a die with a double-center punch having a space between points equal to any desired number of drill. Alternate holes should be drilled first, after which the intervening holes should be made with a drill having a point to fit into an angle of 45° or less. Such a drill will cut into the holes on both sides without running off, as long as the taper guides the drill. The core will drop out of the die after the last hole is drilled.

Drilling Holes through Round Stock

Every mechanic has more or less difficulty in drilling holes centrally in shafting and other round stock, the degree of trouble encountered depending upon the skill of the person doing the work. Even with an accurate layout and great care, the holes are frequently drilled off center.

The method illustrated makes it possible to bore one hole or a succession of holes in cylindrical work with the certainty that all of them will be at right angles to the axis of the work. Also, no layout is required unless a hole has to be a certain distance from the end of the work, in which case a scale can be used, or, where accuracy is required, a depth micrometer, by merely subtracting half the diameter of the bushing from the required dimension. The bushing is turned to exactly the same diameter as the work it is to be used with, and the central hole should be the same size as the one to be drilled in the work. The bushing and the job are then clamped in a vise, or, in cases where the work is too large, between parallels.



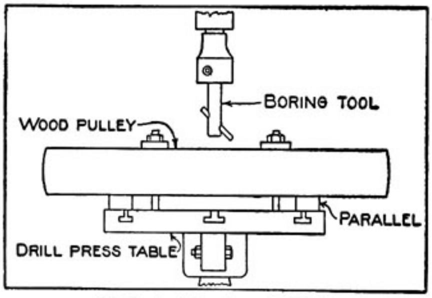
To Make "Centering" Unnecessary

For drilling a hole in a chucked piece, centering is just one operation too many, if this method is followed:

First, face off the end of the piece, making a true spot at least as big as the diameter of the drill. Put a center punch mark where the tool lines indicate the center of revolution. This serves as a rough guide for placing the drill between the tailstock center and the work as usual. Clamp a tool in the tool-post and, on starting the lathe, bring it in contact with the drill and keep it firmly so until the drill is in fully up to the lips. This prevents the drill from wobbling, and when once in true up to its size, it cannot change any more than under any other starting conditions. After being entered, the drill does not need the tool, which should be backed out of contact.

Radial Drill Used for Boring Hubs

There was brought to our shop one day a 4-ft. wood pulley to have the hub bored out 1 in. larger. Our largest lathe would swing only 28 in., so parallels were placed on the round drill and the wheel bolted on top of them. A piece of wire was put in the drill chuck and bent with a pointer, the whole length of the wire being equal to the radius of the wheel, and the wheel trued up with the pointer. A boring tool was placed in the chuck, as shown in the sketch, and fed through the hub at a good rate of speed. The time consumed was no more than if the work was done on a lathe. Donald A. Hampson.

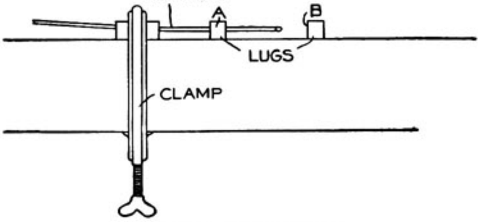


Method of Boring the Hub

❡Painters, carpenters, and others, using ladders frequently, will find that if the center of the ladder, where it balances, is marked with a strip of bright-colored paint, the workman can grasp the ladder at this point immediately when preparing to carry it, thus saving energy and time.

Drilling Projecting Lugs

It often happens that one must drill holes that are so close to other parts, or have projecting parts in the way, as to make it impossible to get the chuck of the drill press or breast drill directly over the hole to be drilled. The usual way is to drill the hole on an angle and finish straight with a file, or to drill a larger hole than is necessary. Frequent examples of such holes are pin holes for doors on the side of machinery and other hardware products.

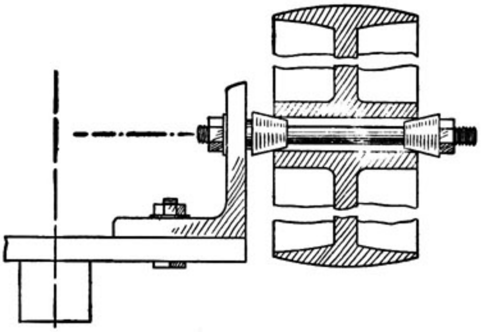


Grinding the Drill Rod

An alternate method is to use a length of drill rod formed into a drill point at one end and gripped in the chuck at the other. This is illustrated in the drawing, where A and B are the lugs on a casting to be drilled for a door hinge. Here the block is held on with a clamp and used for a guide for the drill rod. This block is first drilled the size of the rod and then countersunk at one end—the end the drill enters from the chuck. Sometimes two blocks are necessary. The drill should be supplied with lubricant at this point. Feeding must be done with care and not too fast or the rod will buckle.

Drill Jig for Making Oil Holes in Pulleys

An angle plate is used for the support on the drill-press table and a mandrel is attached to the vertical part and carries two cones having an angle of 30°. This makes it adjustable to the diameter of the bore on any pulley within reasonable dimensions. A pulley is clamped between the cones, as shown, and the drill-press table turned to bring the right location for the hole directly under the drill point.—G. Barrett, Hamilton, Ont.

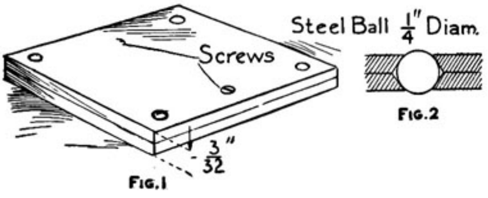


The Jig Can Be Quickly Attached to the Table of the Drill Press

Drilling Holes Central with a Center-Punch Mark

If the point of a drill strikes the side of a center-punch mark, the hole will be drilled slightly to one side of the center because the work will not slide on the metal of the faceplate. I made a device to place between the work and the faceplate that would adjust itself to any slight touch of the drill. The method of construction is as follows:

Procure two pieces of sheet metal 3/32 in. thick by 2 in. square and fasten them together with screws. Drill four 1/16-in. holes about 3/8 in. from each corner. Take the pieces apart and countersink the holes on the inner sides deep enough so that when the plates are placed together, a 1/4-in. steel ball will roll freely and leave a small arc of the ball's surface protrude through the hole. Put a 1/4-in. ball in each hole and screw the plates together.

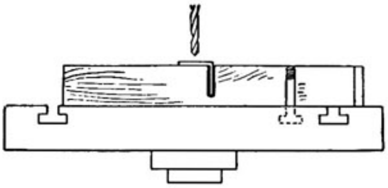


Four Balls in the Plate

Set on this plate the piece of work to be drilled. If the drill does not strike the center-punch mark straight, the plate will shift itself and the work, so the drill will follow the center of the mark. On large work, two or more of these plates can be used.—F. W. Granger, Waterbury, Conn.

Drilling Holes in Angle Iron

Among the many devices used for holding angle iron while drilling, one of the quickest and easiest methods is to make a groove in a block of wood to receive one wing of the angle and fasten the block to the faceplate. True and accurate holes may thus be readily drilled in the angle.—Geo. Lundberg, Huron, S. D.



Wood Block on Faceplate

Interior woodwork should be treated with zinc chloride, bichloride of mercury, sodium fluoride, or chlorinated napthalene. Mercuric chloride is very poisonous, and, as it has a tendency to come off in small quantities, should not be used. Lumber, implement handles, wagons, etc., that cannot be treated with coal-tar creosote, for various reasons, should be stored in creosoted sheds.

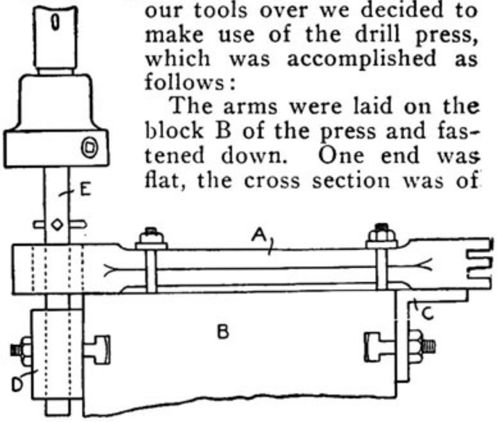
Holding Odd-Shaped Pieces in a Pipe While Drilling Them

In drilling odd-shaped pieces on a drill press, it frequently is necessary to hold them in a vise or some special jig. A piece of suitable-sized pipe can often be used to serve the purpose as well. One end, which should be square with the sides, rests on the drill-press table. The other may be square or suitably cut to fit the irregular piece to be drilled.—D. C. Goff, Knoxville, Tenn.

Boring in a Drill Press

Having some cast-iron arms to bore out for bushings, we naturally turned to the lathe, but found the pieces were just too big to swing over the ways. After looking our tools over we decided to make use of the drill press, which was accomplished as follows:

The arms were laid on the block B of the press and fastened down. One end was flat, the cross section was of irregular form, and under this the knee or angle plate C was bolted. This served to locate the arms at once and leveled them up by this surface so that all were duplicates. To the other side of the block was bolted a casting, D, having a 1-in. hole through it. A boring bar, E, was provided, placed in the chuck of the drill press, and the chuck centered over the hole D. The castings were then trued up by the bar and the boring begun. The job was done as well as in the lathe and almost as quickly.—Donald A. Hampson.

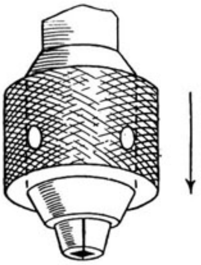


Boring Bar in Drill Chuck

¶When turning or drilling aluminum, use kerosene oil on the cutting edge.

Taking a Drill Chuck Apart

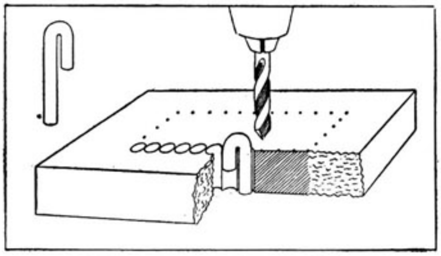
The ordinary drill chuck is so cheap and durable that one seldom gives its construction a thought. Occasionally, however, it is necessary to take one apart for some purpose, and the person who is not familiar with its construction will find this a hard task. Such a chuck is illustrated herewith. A knurled sleeve, drilled for the spanner, surrounds the body, and turning this sleeve loosens or tightens the drill in the jaws. There is no sign of threads, setscrews, or pins, to hold this sleeve on, but still it stays in place and turns around.



This outer sleeve is pressed on and a movement longitudinally will remove it. After it is off, the assembly of the chuck is readily apparent. The chuck is assembled by pressing the sleeve back into its proper place. Sometimes the sleeve becomes loosened after long service and slips when a drill must be held very tightly. The remedy is to remove it and shrink it up a little. To do this, heat the metal to a red heat and immerse in cold water. Repeat this operation if the piece is very loose. Press it back in place, and the sleeve will hold like new.

How to Drill Holes Close Together

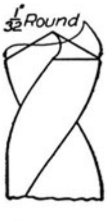
The accompanying sketch shows a simple device for drilling holes close together. Take a piece of steel wire the same size as the drill and bend one end over, as shown. Lay out the work and drill two holes to make a start. Put the long end of the wire in the last hole and the short end in the next one to it. Allow the drill to follow down beside the wire pin, and when the holes are all drilled you will have them all connected and the piece drops out without any trouble or broken drills. This will be of special interest to die makers.



Drilling Close to Another Hole

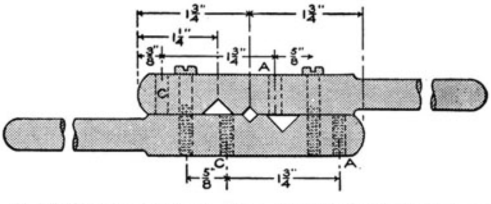
How to Drill Odd-Sized Holes Smooth and True

Quite often a machinist has several small holes to drill of an odd size that should be smooth and exact. An ordinary drill will not make a smooth hole and invariably drills a larger hole than the drill size and because of the odd size a reamer cannot be used. A good way to do the job and get a smooth hole is to first drill through with a drill 1/16 in. smaller than the size required, then take the regular size drill and round the corners of the cutting edges, as shown in the accompanying sketch, and finish the hole out with this.



Tap Wrench Fits Various Sizes of Shanks

This tap wrench was made to take the place of different-sized wrenches. The sketch shows it assembled for small taps, less than 3/8 in. The other notches are used on taps larger than 3/8 in. The wrench gives more leverage with the larger taps, by shifting the handles to the proper notch positions. Both ends are the same. To match the large notches, holes A and C in the upper piece are matched against holes A and C in the lower piece.

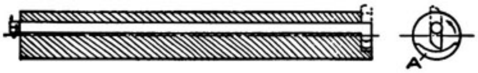


A Single Tap Wrench Does the Work of Several by Reason of the Double Notches

Recessing the Bottom of a Drilled Hole

An ordinary boring tool used to recess the bottom of a drilled hole will spring when the feed is applied. The tool, as illustrated, was devised to prevent the spring as the cut is taken. It is made of a piece of steel the size of the hole to be recessed. A small hole is drilled through the piece lengthwise and a little out of center. The distance the hole is to be drilled out of center will depend on the size of the tool. The cutter is made of a piece of tool steel that will fit the hole, the end being turned and a cutting edge ground on it.

The projection A butts against the bottom of the drilled hole and prevents the tool from touching the end of the hole. The cutting tool may be turned by hand or in a drill press, and when the recess is cut the tool is turned in and the holder removed.—A. Whittle, Quebec, Can.



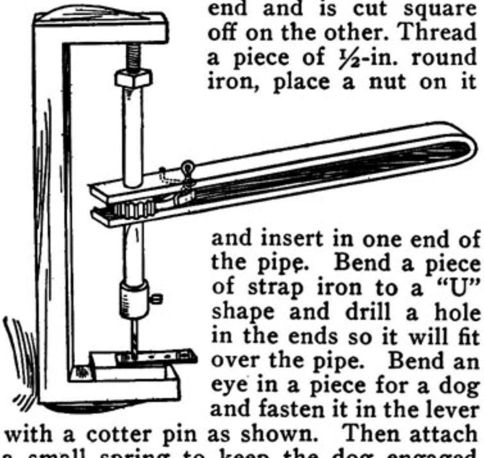
The Revolving Cutter Will Easily Make the Recess without Springing Away from the Work

Oiling a Drill

Oil may be constantly applied to a drill point, as shown in the sketch. Wrap a small piece of cotton waste around the drill at the top, and saturate it with oil. If the drill becomes heated the oil will flow more freely and keep the point well lubricated.—Harry Quinter, Steelton, Pa.

Homemade Ratchet Drill

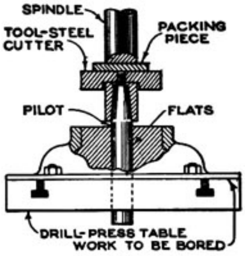
Secure a gear from an old clothes wringer and fit it over a piece of ½-in. pipe which has a coupling screwed on one end and is cut square off on the other. Thread a piece of ½-in. round iron, place a nut on it and insert in one end of the pipe. Bend a piece of strap iron to a "U" shape and drill a hole in the ends so it will fit over the pipe. Bend an eye in a piece for a dog and fasten it in the lever with a cotter pin as shown. Then attach a small spring to keep the dog engaged in the teeth of the gear.



¶A piece of stiff paper or emery cloth, placed between a small piece of metal and the drill-press table, will prevent the metal from turning while being drilled.

Boring in the Drill Press

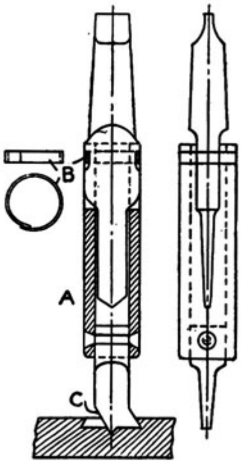
When boring holes of large diameter with a boring bar in the drill press, greater rigidity may be secured by using the spindle itself as the boring bar.



The cutter is inserted in the spindle slot as shown, and a pilot, having a threaded end, and tapered to fit the spindle socket, is used to draw the cutter firmly to its seat, the pilot being provided with flats upon which a wrench may be used. The pilot may be as long as desired, of a diameter suited to the work in hand, of the diameter of the center hole, or a bushing in the drill-press platen. By this method the boring bar is made just as strong and rigid as the machine itself.

Drilling and Undercutting Holes

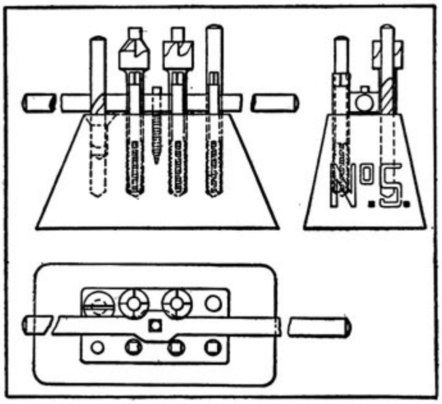
A tool for drilling and undercutting holes for retaining babbitt metal in bearings or other wearing surfaces is shown in the accompanying sketch. The drill is an ordinary flat drill with a widened portion below the taper shank. When the hole is drilled, the undercutting tool, which consists of a piece of steel tube, A, with the cutter fastened inside of the end, is slipped over the drill and held in place with the spring B. The heel C on the point is slightly rounded so that it will force the toe into the metal. There is enough clearance between the drill and the tube to allow the necessary amount of wabble.—J. H. Maysilles, Rochelle, Ill.



¶A scale filed on a bit, beginning at the cutter end, will save the trouble of pulling out the bit every few turns to see if the hole is deep enough.

Block for Holding Taps and Tap Drills

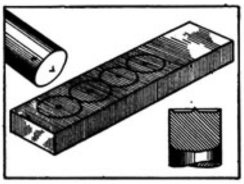
The accompanying cut shows a block which has proved very handy for shop use. It is intended for holding the three taps in the set, one tap drill, one full size diameter drill, one counterbore, one countersink, and a tap wrench. By having the toolroom provided with blocks such as these, when a man wants taps and drills or counterbores for a certain job, he simply asks for block number so and so, and he receives the block with all the accompanying tools.



Tool Set Holder

There is a great deal of time saved as compared with such systems where the man first has to ask for taps, and then for tap drills, and finally for the counterbore and countersink.

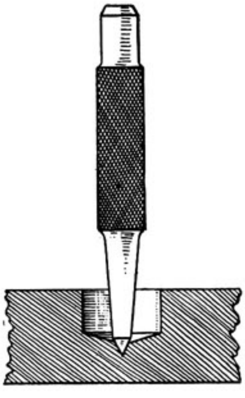
Punch for Laying Out Drill Holes



When laying out a row of holes for cutting out a piece of metal, as in die work, it often requires a great deal of practice to be able to space the holes accurately. A special punch which makes this work much easier can be made from a piece of drill rod the size of the drill to be used. Shape the end, as shown in the illustration; then harden and temper the piece for use as a punch. The manner of using it is evident from the illustration; the small center marks can be deepened with an ordinary center punch before drilling, if found convenient. —J. H. Beebee, Rochester, N. Y.

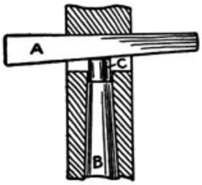
¶Use turpentine instead of oil when drilling hard steel, saw plate, and the like.

Drilling Holes in Metal by Hand



Drilling a deep hole in metal with a brace-drill is a very hard job, as it takes quite a pressure to make a drill point take hold. In order to relieve the point, mark the work with a center punch which is well pointed. Drill until the punch mark is out, then make a new mark, say ⅛ in. deep, and drill again. Continue by marking and drilling and you will be surprised how quickly and easily a hole can be drilled.—Ernest A. Nielsen, Boston, Mass.

Removing a Stuck Shank from a Drill Spindle



The usual method of removing drills or drill chucks from the end of a drill-press spindle is to use a tapered drift. Occasionally, however, some one drives a drill in that has a short stem or shank, which does not reach up to the drift slot so that it can be driven out. The illustration shows such a condition. The drift A cannot touch the end of the drill shank B. Instead of pounding and twisting to get the drill out, procure a short piece of round rod, C, slightly smaller than the drill shank and of such length that, when dropped in on the end of the drill, the drift may be entered in its slot. A little oil on the edges of the drift will be of assistance in either case.—Donald A. Hampson, Middletown, N. Y.

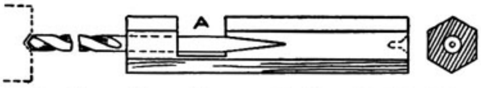
Making Drill Jigs of Cement

Where a number of similar large castings are to be drilled, a cheap and satisfactory jig can often be made of concrete. Steel bushings may be imbedded in it to guide the drills, and handles, hinges, or other parts may be made of steel, as necessary. The concrete may be easily molded into shapes which would be expensive to make of iron.—Irl R. Hicks, Centralia, Ill.

Special Tools and Devices for Drilling

Holder for a Center-Clearance Drill

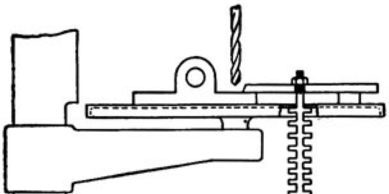
A very simple and handy tool for machinists, especially for those not supplied with combination centering drills, is shown in the sketch. The tool consists of a piece of hexagon brass with a notch cut out, as shown at A, a V-shaped opening cut in the center with a hacksaw, and a hole drilled to receive the shank of a drill and a center hole drilled in the opposite end. The hexagon shape affords a ready grip for the hand. The dotted lines show the work when the holder is in position for use after being centered. The straight shank of the drill is ground tapering, like a chisel edge, to fit into the V-shaped notch cut in the holder.—John Harger, Honolulu, H. I.



Holder for a Center-Clearance Drill to Be Used in a Lathe

Clamp Bolt for a Drill Press

The ordinary clamping of metal parts to a drill press for drilling is inconvenient because no two pieces are of the same thickness and the clamp jaw will require different lengths of bolts, a complete supply of which would consist of so many that time would be wasted in looking for the right length. I devised a bolt with many heads, which was cut from a flat piece of metal of suitable size to fit the slots on the faceplate and could be quickly adjusted to clamp metals of reasonably varying thicknesses. The bolt is slipped through a slot in the drill-press faceplate and given a one-quarter turn when set on the clamp at the proper height.—E. W. Lawrence, Pittsburgh, Pa.

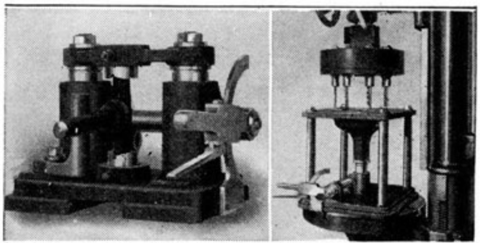


Clamp Bolt in Its First Position for Holding a Thin Piece of Metal for Drilling

Universal Drill Jig Saves Time in Shop

Two types of universal drill jigs, designed to take the place of the common leg-and-box and screw-bushing jigs, respectively, are now available.

The first type consists of a square base with a post at each corner, carrying the plate that contains the drill bushings. The work is set under the plate and locked in position by a plunger, which is forced up by a handle and locked by means of a simple latch. The latter type is similar, except that there are two plungers, carrying the bushing plate, and working downward against the work. These jigs are much more convenient to use than common jigs, as it is merely necessary to place the work on the lower bushing, in one type, or on the plunger in the other, and to pull the handle down, thus locking the piece securely; there is thus no need of removing the jig after once placing it on the drill-press table, and loading and unloading is rapid. Any number of different parts may be drilled by changing the bushings or top plate.



Left, Bushing Type of Jig, with Work in Place; Right, Plate Type on Drill-Press Table

Chip Magnet for Drill Holes

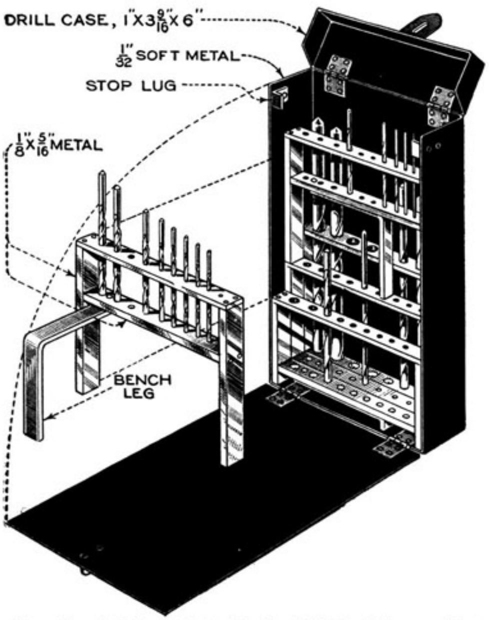
When drilling holes in parts that cannot be turned over, the little tool shown in the sketch cannot be excelled for removing the metal chips from the bottom of the holes. It is made of a piece of ⅛-in., or larger, drill rod. The rod has a slot cut in it, as shown; then the steel is magnetized by placing on an electric generator, or, by wrapping a coil of insulated wire around the head end and passing an electric current from a battery through the wire.

Small Rod Magnet

Case for Small Drills

Twist drills, especially those of the smaller or numbered sizes, are difficult to keep in proper order when dumped into a compartment of a tool box; besides, time is consumed in hunting for the size wanted, and the drills are liable to injury from contact with other tools. To make all the drills readily accessible, so that the proper size can be selected without hesitation, and prevent them from damage, the case illustrated provides a neat addition to the mechanic's tool kit.

It is made of sheet metal, to any dimensions desired, although the size indicated is convenient for the tool chest. The top and front flaps of the case are hinged and provided with a small hasp so that a split ring, or lock can be used to keep it closed. Two angle pieces are fastened to the sides, inside and near the top, to serve as stop lugs for the flap cover.

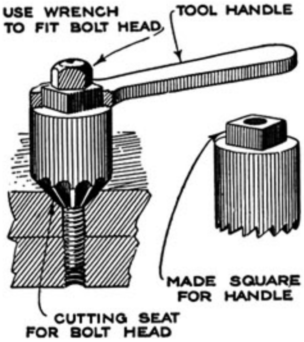


Case for Holding Twist Drills Which Makes a Neat Addition to the Mechanic's Tool Kit

The drills are held in their proper order in a series of graduated drill benches, made of flat stock. Each of these benches is provided with a leg that folds underneath, so that a series of drill sizes can be taken from the case and stood on the bench. Five benches, as shown, will hold drills from No. 1 to 80, although the last bench, which holds the sizes from 56 to 80, can be dispensed with if extremely fine work is not done. The size of the drills may be stamped on the upper cross-pieces of the holders, or the numbers may be stamped on a piece of sheet metal to be attached a little below the top shelf.—P. A. Daschke, Astoria, L. I.

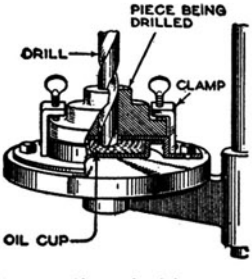
Hand-Operated Counterboring and Countersinking Tool

A hand-operated counterboring and countersinking tool, such as the one shown in the drawing, will find many uses around the shop. The countersinking tool is serviceable for obtaining accurate alinement of countersunk bolt heads in boiler and plate work. After drilling and tapping, an ordinary bolt is inserted through the tool and the desired amount of metal is removed by rotating the handle, the proper cutting pressure being obtained by screwing down the bolt with a wrench, or a wing-headed bolt, for tightening with the fingers, can be used. Use of this countersinking tool causes the bolt to seat evenly, as the seat is cut concentric with the threaded hole. The counterboring tool is nearly the same as the countersink, but is used for spot facing the rough surface of a casting to provide a seat for cap screws or nuts.



Jig Makes Drill Self-Oiling

Having a number of pieces to be drilled, similar to the one illustrated, I made a jig of such design that the point of the drill, on lubricating one piece of work, takes up oil, to be used in drilling the next piece, from a cup built in the jig. It takes no longer to remove and insert the work than when using an ordinary jig of this type, and the work of oiling the drill is saved, besides insuring that the drill will always be lubricated as long as the cup holds oil.



Counterweights on Portable Drills and Other Heavy Tools

In a factory where a careless operator had allowed an expensive electric portable drill to roll off the bench and become ruined, similar drills were suspended by sash cord from 2½-in. iron pulleys held up with 1-in. screweyes. The other end of the cord carried a counterweight, which just balanced the drill at any height. A knot was tied in the cord above the drill to prevent its getting out of reach when raised. The cord was attached to a band, bolted around the drill at its center of gravity, so that it remained suspended

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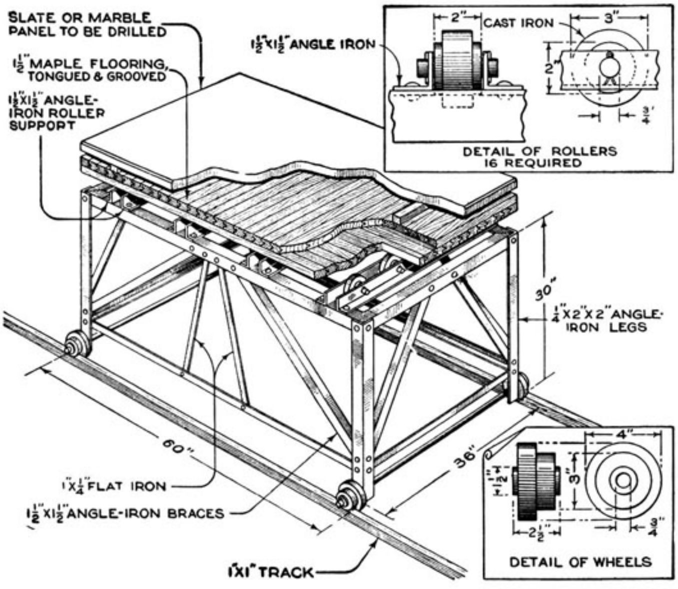
Movable Table for Drill Press

By ARTHUR F. COX

IN a shop which makes a specialty of drilling and assembling slate and marble switchboard panels, the drilling is done on a radial drill, the panel being supported on the special table shown in the drawing. This table permits one man to handle the largest panel with ease, and adds considerably to the efficiency of the drilling machine.


SLATE OR MARBLE PANEL TO BE DRILLED
1½" MAPLE FLOORING, TONGUED & GROOVED
1½"X1½" ANGLE-IRON ROLLER SUPPORT
1½"X1½" ANGLE IRON
2"
CAST IRON
3"
2"
¾
DETAIL OF ROLLERS 16 REQUIRED
30"
¼"X2"X2" ANGLE-IRON LEGS
60"
36"
1"X¼" FLAT IRON
1½"X1½" ANGLE-IRON BRACES
1"X1" TRACK
4"
1½"
3"
2½"
¾"
DETAIL OF WHEELS

A Table That Is of Particular Convenience in Shops Where Large Slate or Marble Panels Are Drilled: The Accuracy of the Work Is Increased and the Output Augmented

As shown, the table is built up of angle iron, the four legs being provided with flanged wheels, made to the dimensions shown in the detail drawing, and the whole table moves longitudinally on a track composed of 1-in. square cold-rolled steel, fastened to the floor. These wheels also permit the table to be easily moved to any part of the shop. The table top is made of two layers of tongued-and-grooved hardwood flooring, the upper layer being laid at right angles to the bottom one. The table top runs on four rows of rollers, which are mounted on pins fastened by cotter pins through the angle-iron cross members. This table reduces the cost of the drilling operation considerably, as, by the combination of motions possible, the hole to be drilled is located much more quickly and easily than by using the drill motion alone.

Further, the risk of breaking panels is greatly reduced by the use of the table, and it forms a substantial piece of equipment, in contrast to the usual flimsy wooden support used for this class of work, which generally necessitates two men to handle the panels, and makes drilling a slow and inaccurate job, due to the weight and friction of the panels in moving them over a rough wooden surface. The pins on which the various rollers run should be casehardened, and should be lubricated frequently to insure the utmost freedom in both movements of the table.

Tapping a Hole without a Tap

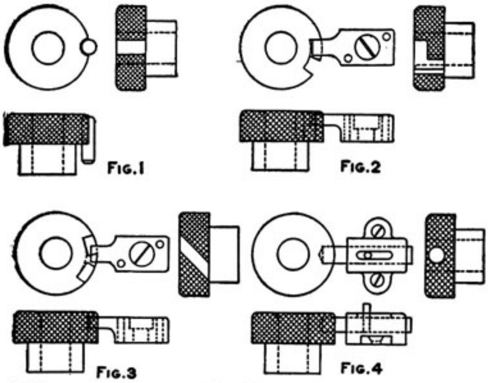
After removing a stay bolt, it was found that a tap of the proper size was not at hand. To retap the hole a stay bolt was used. Its end was pointed with a file, and grooves were filed running longitudinally as in a tap. The bolt was then casehardened, and the retapping of the hole was done in the ordinary manner.

Slip Bushings for Jigs

Parts that are drilled and reamed in a jig at one setting usually require slip bushings, one each for the drill and reamer, and sometimes more for subsequent operations. Unless some means is provided to prevent it, the bushings will turn with the tool, which rapidly wears both the stationary and slip bushings. It is obvious that the accuracy of the jig is quickly lost under these conditions. The sketch shows some of the different methods used, which are simple and inexpensive and will give satisfactory results.

That shown in Fig. 1 is perhaps the simplest of them all: the straight pin prevents turning, but does not keep the bushing from working upward. It does very nicely where there is a limited number of parts to be worked, or in extreme cases where the cost of the tool is the first consideration.

A method that is much used and gives satisfaction is shown in Fig. 2. The cutting of the step makes this one a little more expensive than the others. The rotation of the tool keeps the notched part of the bushing solidly against the finger.



Different Methods Used in the Construction of a Holding Device for Jig Bushings

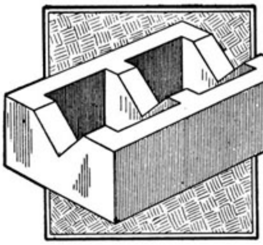
A method that gave better results than any of the others is shown in Fig. 3. A slot is cut on an angle of 45°, which was found ample to keep the bushing firmly seated and at the same time not wedge itself to prevent turning with the fingers in the opposite direction for removing.

The one shown in Fig. 4 is kept in place with a pin and plunger. It may be further improved by adding a small spring, to prevent any tendency of the plunger to work out. Its principal advantage is the simplicity of work on the bushing, although the plunger and housing are more expensive to construct than the other similar devices.

It is sometimes advisable to leave the dowels out of the fingers shown in Figs. 2 and 3. In case the tool catches or sticks in the bushing, it will turn, using the screw as a pivot, and prevent breaking the end from the finger.—A. Dane, Pottstown, Pa.

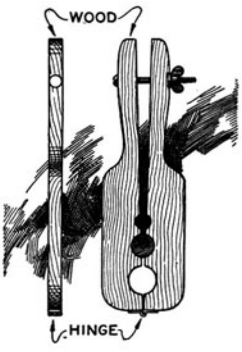
An Improved V-Block

A V-block, very useful when drilling holes in round stock, is shown in the illustration. The usual practice, where it is desired to keep the faces of the "V" free from drill marks, is to clamp the work upon two blocks, drilling between them. By making cast blocks of the design shown, the necessity of using two blocks is eliminated, as the recesses provide plenty of clearance below the work if the drill is fed down a little too far. For drilling short pieces especially, this type of block will be found very useful.—A. C. Cole, Chicago, Ill.



Tool for Holding Polished Metal Parts in Machine Operations

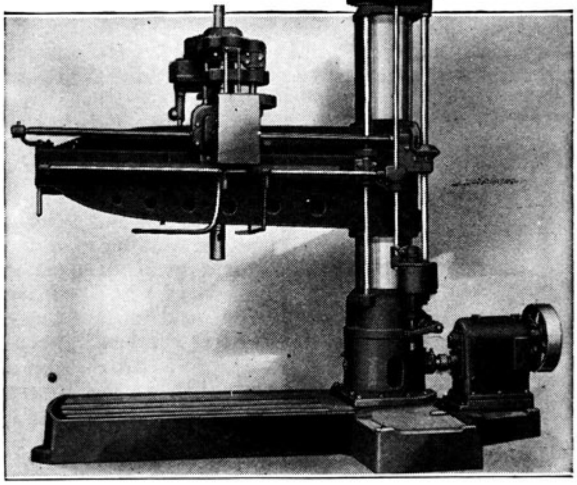
It is sometimes necessary to drill holes in highly polished metal parts, or those having threads on the outside surface. To hold such parts in a vise, a wooden holder should be made, as shown, suitable for several sizes. The holder consists of two strips of wood, shaped, and hinged together. The free ends have a bolt through them tightened with a wing-nut. The holder may be held tight by pressure of the handles on light work, and the grooves shaped to suit special jobs.



¶Caliper a bored hole at several points in its length, as the size at the opening may be misleading.

COLUMN-CLAMPING DEVICE FOR RADIAL DRILLS

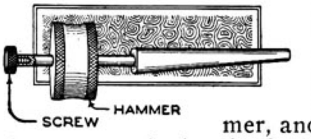
To overcome the inconvenience of clamping the swinging arm and column of a large radial drill by hand, a power-operated clamping device that is operated from the drilling point has been developed. It consists of an oval box that is attached to the lower bearing bracket of the vertical driving shaft, and that by means of friction clutches drives a left and right-hand threaded spindle below the box. This raises or lowers a nut to which is forked a lever. The hub of this lever is tapped and works on the column-binding screw. The engagement of the friction clutches in connection with the threaded spindle is accomplished by a cam on top of the oval box, which is operated by splined vertical and horizontal shafts, a pair of bevel gears, and a lever and links attached to and moving with the head. The friction clutches are self-releasing.



Power Column-Clamping Device for Radial Drills: The Device Is Attached to the Lower Bracket of the Vertical Drive Shaft

A Handy Drill-Press Drift

A handy drift for knocking out sockets or taper-shank tools, made as shown in the drawing, does away with the necessity of using a hammer, and leaves one of the operator's hands free to catch the socket or tool as it is released.



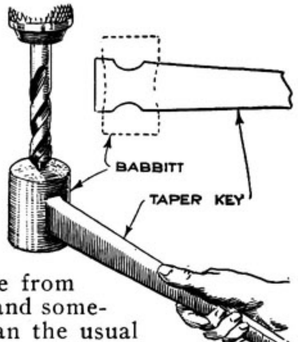
Made of ¼-in. flat stock, it is turned down at one end to form a guide for the sliding weight which takes the place of the usual hammer; the screw in the end prevents the hammer from sliding off. The side of the hammer is made concave to provide a better grip for the fingers. The drift is used in the same manner as ordinary ones, the blow of the hammer against the end of the tapered drift releasing the socket or tool.

Friction Hold for Drilling

A piece of metal of such a shape that it is hard to hold and too small to bolt on a drill-press table makes a difficult thing for drilling. Such a piece of metal can be kept from turning by placing a stiff piece of paper or emery cloth between it and the table. This method is very effective.—H. W. Hankin.

A Combined Hammer and Drift

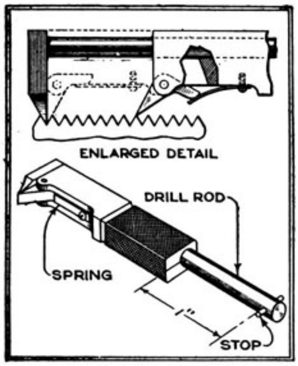
For the particular use of drill-press operators, the combination lead hammer and drift not only saves the operator's time, but he always has at hand the means of driving a drill firmly into its socket without damage. The taper key or drift is made from flat-steel stock and somewhat longer than the usual key, because it must serve for the handle of the hammer, as well. The lead or brass hammer head is cast around the large end of the key, which protrudes about ¹⁄₁₆ in., to form a convenient projection to strike when the key is used for driving out the drill.—M. E. Duggan, Kenosha, Wis.



¶A broach should only be used in work for which it is designed. If the broach is to be used for work of varying length, the broach maker should be given this information. Then, if the variation is not too great, the broach may be designed to meet the conditions.

A Novel Thread Gauge

To count the number of threads per inch when the pitch is small requires considerable care, especially when the work is internally threaded, as it is a very easy matter to miscount and perhaps spoil a piece of work that is to be duplicated.



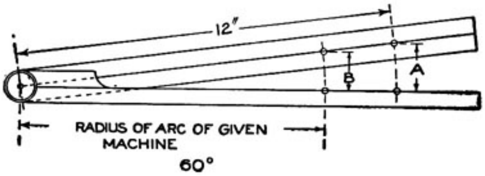
The gauge shown in the drawing is made from ¼ by ½-in. stock, drilled for a piece of 5/32-in. drill rod, and slotted at the end to fit the pivoted jaw. The end jaw is permanently riveted to the end of the drill rod, both jaws being shaped and mounted so that, when placed together, they will form a 60° angle; a light, flat spring bears against the pivoted jaw. A pin is inserted in the outer extremity of the drill rod, just 1 in. from the end of the block, when both jaws are together. A hole for a similar pin may be drilled ½ in. from the end of the block, for the measurement of short threads.

To operate the gauge, the jaws are placed together with the points in a convenient thread; then, with a slight downward pressure, the movable jaw is pulled back steadily. As the spring-actuated jaw rises and falls over the threads, a distinct knock will be clearly felt by the fingers. When the jaw has been pulled back to its limit of travel, the number of "knocks," or "clicks," counted will indicate the exact number of threads to the inch. The gauge is, of course, only accurate where there is an integral number of threads per inch.

Taper Gauge for Boring Mills

The fact that the boring mill is one of the most difficult machines to set for a true taper, brought about the making of the gauge shown in the sketch for this work. It consists of two pieces of steel, 1/32 in. thick, 1 in. wide, and 15 in. long, jointed like a blacksmith's rule. A true center is left in the jointing screw and from this point a center line is drawn on each blade. The upper blade is cut along this line to within about 2 in. of the joint, and the edge is trimmed and beveled so that it coincides with the line on the other blade. An arc of a circle is marked on both blades 12 in. from the center of the joint, and the space between is graduated as fine as desired, but for ordinary purposes a fine center-punch mark at a corresponding point on each 12-in. arc of the two blades will be sufficient, if accurately measured.

To use the tool for any machine, set the dividers to 60° of the graduated arc and lay out that distance on both blades. When the points at 12 in. are the required distance apart, the distance through which the zero mark on the machine must be moved is found at the arc which represents the circle of the machine, and it is only necessary to transfer this distance with the dividers. The distance A is equal to one-half the required taper per foot, and the distance B is the distance to move the zero mark to cut the required taper. It must be remembered that the boring head is set just one-half of the total taper per foot, and it is most important that the cutting point of the tool is set on the center line parallel to the cross rail.—Thomas M. McKnight, Willoughby, Ohio.



Gauge for Setting Boring Mills or Other Machines to Do Accurate Taper Work

A Ball-Grip Self-Centering Drill Chuck

The small chuck shown in the accompanying sketch can be easily made by any one who has access to a screw-cutting lathe. As the diagrams show, three steel balls replace the usual jaws, the balls fitting in guides consisting of radial holes drilled in the body of the chuck. The balls are closed on the tool to be held by the hollow sleeve, which is bored out with an internal taper, and screws on to the body of the chuck with a left-hand thread. When the drill to be held is pushed in, its end centers itself in the taper end of the hole and the balls grip it centrally when tightened up by the sleeve.

It is important that the sleeve should be attached by a left-hand thread, as this makes the chuck self-tightening. Looking along the drill at the front end of the chuck it rotates, when slipping, in a clockwise direction. This causes the balls to roll in the opposite direction, and to transmit a similar rotation, i. e., counter-clockwise, to the sleeve, which is thus tightened up.

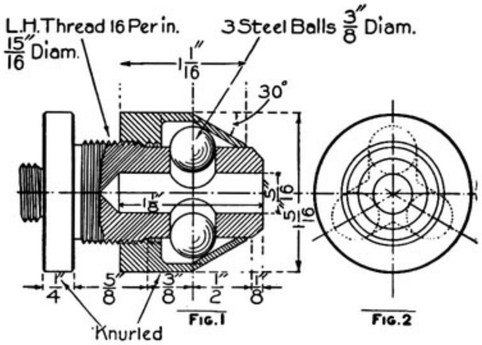


FIG. 1 FIG. 2

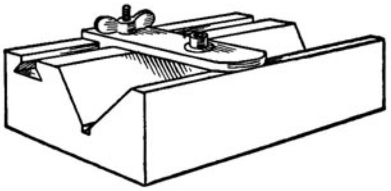
Details of the Chuck

A sectional view through two of the balls is shown in Fig. 1, and an end elevation from the front of the chuck in Fig. 2. The size given is for holding drills up to 5/16 in., 1/16-in. drills being the smallest it will hold. The balls are 3/8 in. in diameter, so they cannot fall out through the center hole.

The holes for the balls should be carefully drilled and filed or scraped so that the backs of all the holes are at the same distance from the front. This insures the proper centering of the drills. The chuck is improved by casehardening the sleeve and ball guides, but this is not necessary.

An Adjustable V-Block

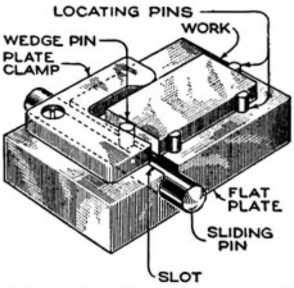
The adjustable V-block shown in the illustration will be found very handy for drilling clevis pins or similar articles. The drill-bushing slide can be adjusted to any distance from the end of the block and is fitted with removable bushings for any size drill desired. The underside of the head of the pin strikes the end of the V-block and insures a uniform length of pin from the head to the hole to be drilled.—Henry J. Marion, Pontiac, Mich.



An Adjustable Bushing Slide Makes It Possible to Drill Holes Accurately in Pins

Rapid Jig Clamp

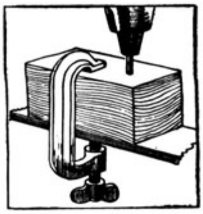
Drilling flat plates of square or rectangular shape is a common shop operation, and simple jigs are, as a rule, used to hold the work, more especially if there are any number of pieces of approximately the same size to be drilled. Such jigs generally take the form of a flat plate fitted with bushings for the necessary holes, the work itself being located against flattened pins and held by two screws at right angles to each other. For work of accurate dimensions, the double-plate clamp shown is much to be preferred to the screws, as the work is gripped or released by a single movement. The clamp is made of flat stock, which should be slightly thinner than the work, cut to the shape shown, and drilled and counterbored for a round-headed screw. Through the side of the jig body a hole is drilled for a sliding pin, which has driven in its center another pin; the latter forming a wedge that slides between the work and the taper side of the clamp. The hole for the sliding pin should be drilled as close to the top as possible and a slot cut through afterward to clear the wedge pin.



In use, the work is laid in place, and the sliding pin is tapped on the end with a light hammer. This forces the wedge pin between the end of the work and the taper of the clamp; this has the effect, as will be seen, of tightening the work from both sides at the same time. A tap on the opposite end of the sliding pin, of course, releases the work.

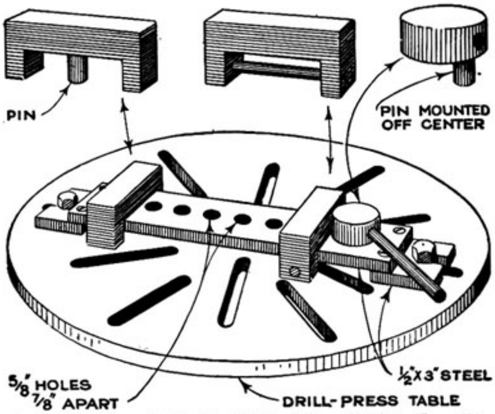
Safe Way to Use Small Drills

A small twist held in a breast-drill chuck is very liable to break when drilling metal because of the pressure and the uneven pull on the gear wheel. Clamp a block of wood to the metal, as shown in the sketch, and drill the hole through both wood and metal and you will avoid the breaking of drills.



A Simple Drill Vise

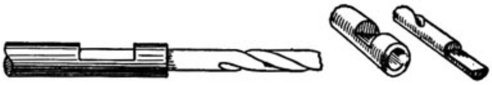
A very efficient, quick-opening and closing vise for the drill-press table, is shown in the drawing. The steel bar which forms the bed of the device is provided with holes at regular intervals and supported from the drill-press table, at the ends, by pieces of the same stock, provided with slots for bolting to the table. The jaws are movable on the bar, the fixed one having a pin driven into it which fits into the holes; the movable jaw is held in place by a horizontal pin riveted to the sides, as shown. The cam consists of a disk of steel shafting into one face of which a pin, to fit the holes in the bar, is driven eccentrically. At right angles to this pin a handle is inserted into a hole in the circumference of the cam.—C. H. Willey, Concord, N. H.



An Efficient and Easily Made Vise, Which Can Be Quickly Adjusted and Operated

A Twist-Drill Driver

When a hole must be drilled in a deep groove, recess, or place, and an ordinary drill is not long enough, it is quite common practice to forge a former or flat drill on a length of tool steel, leaving a shank long enough to reach the required distance or more. But a flat drill cuts slowly and takes more power than a twist drill and it is apt not to drill the proper size



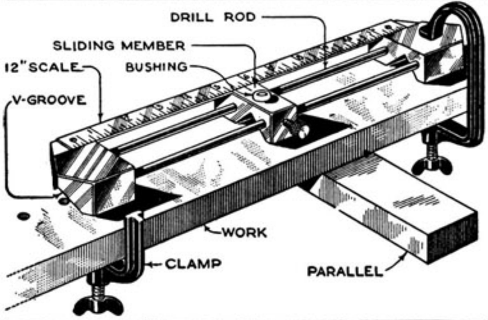
An Extension Twist-Drill Driver for Drilling Holes in Places That a Short Drill Will Not Reach

If a twist drill is at hand, a strong and simple driver can be made for it by using a piece of machine or cold-rolled steel, and at a cost no greater than the forging of a flat drill. First make a saw cut through the center of the metal on the shank end and then cut out the piece so formed, about ½ in. long as shown. This leaves a positive driving-shank end on the drill. Drill a hole in the bar of steel, about 1 in. deep and having the same diameter as the drill to be used. Above this drilled hole cut a notch through one-half of the steel bar, making the notch fully as long as that on the drill-shank end and so that it will meet the end of the drilled hole. Slip the shank of the twist drill into the hole, passing its extending end up over the notch in the bar, and a combination tool will be had that is very good.

An Adjustable Drilling Jig

Anyone who has had the job of marking off and drilling a long series of holes knows how slow and, usually, inaccurate the work is, when done by ordinary methods.

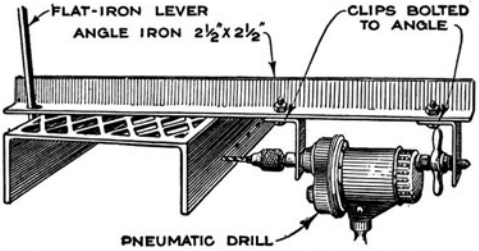
The adjustable jig shown in the drawing saves much time and assures accuracy. The device consists of three machine-steel blocks, each drilled with two ⅜-in. holes, to take two pieces of drill rod. The two endpieces fit tight, and the center piece is made a sliding fit, and should have a clearance of a few thousandths at the bottom, in order to slide freely when the end blocks are clamped to the work in the manner shown. The sliding center block is drilled to take standard bushings, and a line is scribed through the center of the hole on top. A 12-in. steel scale, fastened to the end blocks, makes it possible to space the holes accurately by moving the central block until the mark on it lines up with the desired measurement on the scale, a setscrew being provided to hold the block stationary. V-grooves may be cut into the blocks in order to use the jig on round stock.



Adjustable Drilling Jig by Means of Which a Number of Holes Can Be Accurately Lined Up and Spaced

Simple Rig Helps Overhead Drilling

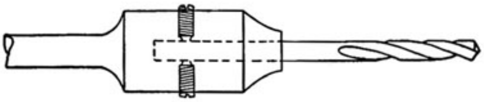
Having a large number of holes to drill in some gratings that were suspended at a distance above the floor, the workman on the job found that the regular hook-and-board "old man" method was too slow. The work was greatly facilitated by using the rig shown in the drawing, in which the pneumatic drill used was held in an angle-iron holder. A hole is provided at the outer end of the angle-iron arm through which a lever is inserted as shown, for exerting pressure on the drill point against the metal being drilled.—Edward N. Snowdon, Boothbay Harbor, Maine.



Simple Rig, for Drilling Holes in Overhead Gratings, Faster than Usual Type of Hook-and-Board "Old Man"

Holder for Broken Drills

The accompanying illustration shows a design of a holder for broken twist drills. The hole is bored the size of the drill and setscrews with rounded points are placed opposite each other. These enter the flutes of the drill and make a positive drive. The other end of the holder is turned to fit the chuck.



Drill in Holder

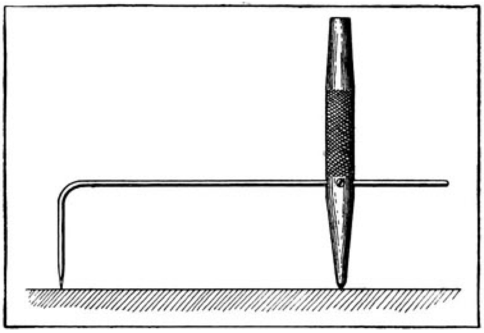
These holders soon pay for their making. In one instance, a new high-speed drill, costing $2, was broken off by carelessness right at the end of the flutes. If it had not been for the holder made for the drill, it would have been worthless, as when broken it would not run true or positive enough for the work. Fitted with the holder it ran every day for over three months.—Donald A. Hampson, Middletown, N. Y.

¶By reversing the handle on a dust brush which has been worn near the point, additional wear may be obtained.

A Spacing Center Punch

The old method of laying off centers for holes with dividers and then following up with a center punch is not very reliable. When stepping off the divisions the mechanic is liable to draw the marks both ways and in the end be out ¼ in. if there are very many holes to lay out. The tool as illustrated is nothing more than a common center punch with a 3/16-in. hole drilled through the body to admit a 3/16-in. rod which is fastened in the punch with a small screw. The rod is tool steel, shaped as shown, and hardened on the point.

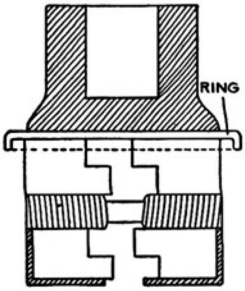
The distance wanted between holes is set with a scale, adjusting the rod so that the steel point and the center point will make the length of the division. Start by making a center-punch hole at the proper place, then set the steel point in the center-punch hole and the right distance will be spaced for the next point which can be made with a blow from a hammer on the center punch. Change the tool over for each succeeding mark.—Joseph Weaner, Plainfield, N. J.



Spacing the Marks

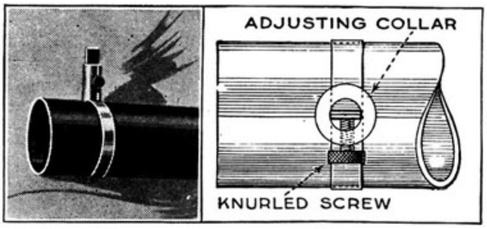
Jaw Holder for a Drill Chuck

A certain type of chuck will cause some trouble by coming apart when running without holding a drill, or when a beginner turns it in the wrong direction. This trouble may be easily overcome by shrinking on the chuck a ring having a recess that will allow the jaws to back up just far enough to admit the size drill which it is intended to hold.



Gauge for Marking Tubes

To facilitate the drilling of a circle of holes in tubing or cylindrical work, the marking gauge shown in the illustration will be found useful. Generally, if a shaft has to be drilled with any number of holes around the circumference, it is first "nicked" with a tool while it is running between centers, but this method is not always possible in the case of tubing, as it may not run true enough.



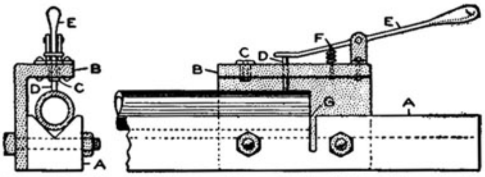
A Simple Gauge for Scribing a Line around Tubing or Other Cylindrical Work

To make this gauge, a piece of flat, flexible steel, long enough to fit around the various sizes of tube, is required. A long collar, of small diameter, is tapped in the side for a knurled tightening screw, and drilled in the center to take the double thickness of spring steel snugly.

In using the gauge, it is slipped over the work, the two ends of the steel band are pulled through the collar and the screw tightened. A scriber is then run around the work, the point bearing against the edge of the gauge, and if the gauge is properly made, this line will be exactly true and at right angles to the bore. It is apparent that the same gauge can be used for shafts as well as tubes, as, in many cases, the appearance of the former is spoiled by a mark such as made by a lathe tool.

Jig for Drilling Holes in Pipe

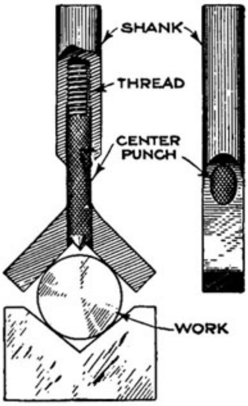
This jig was designed for drilling holes in small pipes and tubes. The specific job required that the first hole be a certain distance from the end, and the other holes spaced uniformly in a straight line. The main part, A, of the jig has a V-groove along its length in which the pipe rests. On the upright B are mounted the drill bushing C and the locating device. This consists of the plunger D, actuated by the lever E and the spring F. A slot is milled across the body at G. In using the jig, a snug-fitting strip of metal is placed in this slot as a stop for the first hole. Then the strip is removed. When the first drilled hole comes under the plunger D, the spring forces the plunger into the hole, locating the pipe for the next hole. The lever E is then pushed down, raising the plunger, and the pipe is moved until the plunger drops into the hole just drilled, this process being repeated for each hole.



The Pipe Is Set in the Jig and the Holes Spaced by Means of the Lever Device

A Shaft-Centering Gauge

The device shown in the drawing will be found very convenient for prick punching a shaft or other round stock that is to be drilled, with the assurance that after the drilling has been properly done the hole will be exactly through the center.

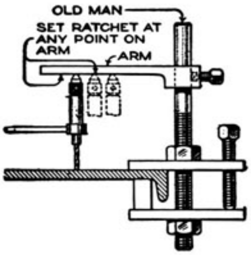


The V-piece is made from a piece of ⅜ by ¾-in. stock, split at one end to form the "V." The shank is then turned down to ⅜-in. diameter, gripped in the chuck to run dead true, and the center is bored out to clear ¼-in. rod, the back end being bored to ¼-in. tapping size. The shank is cut away on opposite sides, as indicated, and a punch is made to fit the hole. The punch is threaded at its upper end, the remainder of its length being knurled.

When the work is bolted to the drill-press table, the gauge is gripped in the chuck or made to fit a socket and brought down to touch the work with the punch screwed up out of the way. The stock is adjusted to the proper position by moving the table until both sides of the gauge touch it. The spindle of the machine is then raised a little, and the punch is screwed down with the fingers, when one or two raps with the spindle lever marks the center. The gauge is then removed, the drill inserted in its place, and the hole drilled exactly in line with the spindle, and through the center.

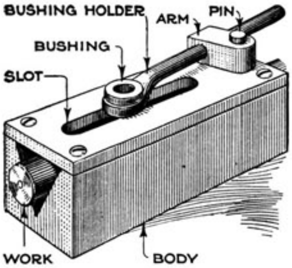
Old Man and Ratchet

A compact and adaptable old man for use with a ratchet drill is shown in the cut. It is especially useful as being attachable to almost any part of a machine where a ratchet and drill is required to be used. The ratchet may be set at any point under the arm, as shown. This arm may also revolve on the old man, so that the hole may be drilled at any point within a circle of a radius equal to the length of the arm. The arm is also adjustable up or down, to accommodate the length of the drill.



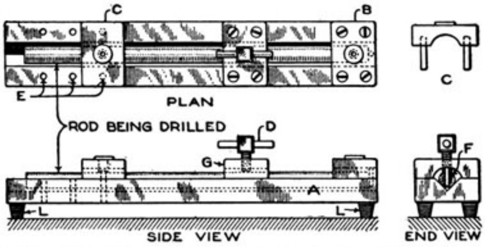
Self-Locking Drill Bushing for Slot Jig

In all cases where holes are drilled with their edges close to each other, the novel method of locking a drill bushing shown in the drawing will be found of great assistance. It is shown applied to a box jig used to drill the cores of boring-bar slots, but, of course, can be used in any work of a similar character. A slot is cut in the top plate of the jig, wide enough to take the drill bushing snugly. In line with this slot a pin is driven in the plate; this carries a square steel arm, which in turn, carries the bushing holder, the latter being a piece of drill rod flattened at one end and drilled for the bushing. It will be seen that, when the bushing is in the slot, it is impossible to move it backward or forward. When it is desired to change the location of the bushing, the holder is lifted, bringing the bushing out of its slot; the arm slides up the pin at the same time. The bushing holder is then pushed farther in or out of the arm, as required, and pushed down again until the bushing enters the slot. Holes can be drilled very closely together in this manner without danger of breaking through, or, if it is desired that they break into each other, no fear need be entertained that the drill will break.—Harry Moore, Montreal, Can.



A Jig for Holding a Round Rod to Be Drilled

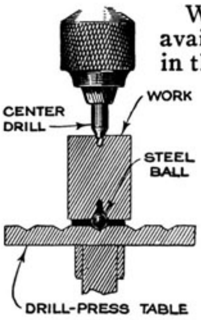
Holes in small round rods may be drilled accurately and quickly at the locations required by using the jig shown in the drawing. A bar, A, of machine steel, in which a V-groove has been planed, constitutes the body. One block, B, equipped with a drill-hole bushing may be attached with screws at the location where one hole is to be drilled. Another block, C, also equipped with a drill-hole bushing, is adjustable. Guide pins on its under face engage in the holes E in the bar. These holes are so located that the holes in the rods will be drilled where required. The block G is fastened with screws. It is drilled and tapped for a setscrew, D, which clamps the rod tightly, thus preventing it from turning. The stop pin F locates the rod accurately in the groove. Lugs, L, attached to the bottom of the bar, permit the fingers to pass under it so that it can be adjusted readily on the table of the drill press.—E. S. Goodell, Chicago, Ill.



With This Jig Small Round Rods Can Be Drilled Quickly and Accurately. It Is Easily Adjusted

Steel Ball Aids in Centering Work

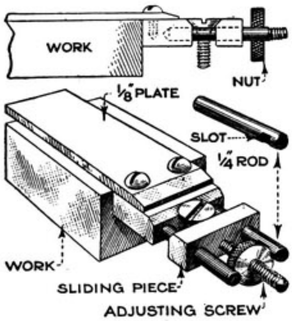
Where no centers are available for centering work in the drill press, a steel ball of suitable diameter can be placed in a drill mark on the drill-press table and the work placed on it as shown. The drill mark should first be lined up with the head by running a long drill down into the spot.



¶To remove stains from the hands, rub them well with a mixture of cornmeal and vinegar before washing in the usual way with soap and water. Laundry soap placed under the finger nails will prevent discoloration.

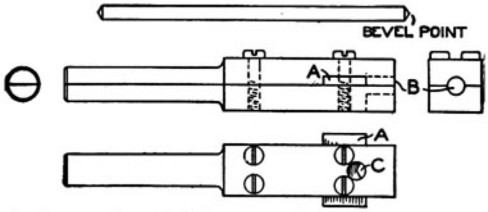
Setting a Countersinking Tool

When numbers of different-sized screw holes are to be countersunk, the device illustrated is a real timesaver as well as a means of preventing unsightly holes. Whether a countersink has an adjusting sleeve, or whether it is set by the machine stop, it is necessary to use the cut-and-try method for the first hole or two, and naturally it is not uncommon to see work with a poor appearance, caused by one or two deep countersinks. To make the gauge illustrated, obtain a long piece of ⅛-in. flat steel, and fasten it to a short piece of ⅜-in. stock with two screws; then bevel off one corner at the same angle as the screw heads. Two ¼-in. pins are driven into one end of the ⅜-in. piece, and sliding on these is another piece of ⅜-in. stock, beveled on the upper and inner edges to correspond with the angle on the head of the screw. The center of the sliding piece is tapped for a ¼-in. stud that carries a knurled nut, the outer diameter of which fits easily in two shallow slots filed or milled near the ends of the pins. When in use, the device is laid on the work and held down by one hand, and the screw to be used is dropped between the beveled edges. The nut is then turned until the screw lies flush with the surface of the ⅜-in. pieces; it is then removed, the countersinking tool is brought down, and the stop set. It will be apparent that in this manner the tool will be set to its correct depth at once without any preliminary cuts.



Pointing Rod Ends

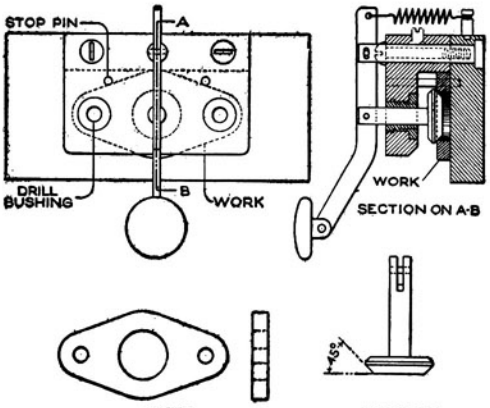
Where it was necessary to bevel-point the ends of several thousand pieces of cold-rolled steel rods, each 6 in. long, true and concentric with the stock, a special tool for doing the work had to be constructed. The tool was made of two pieces of metal, ¼ in. thick and ½ in. in width, secured together as shown and having the ends centered and a 5/16-in. shank turned on one end. Then a slot, 3/32 in. deep and ⅜ in. wide, was cut in one member, to admit the cutter A, which was held in place by the fit and two screws. The hole B was made the size of the rods and the hole C was drilled for clearance of the chips. The beveling edge of the cutter is plainly seen in this hole. The tool was held in a drill-press chuck and fed on the ends of the rods in the manner of drilling holes. The tool can be taken apart for sharpening. It was inexpensive and did its work quickly and satisfactorily.—Donald A. Hampson, Middletown, N. Y.



An Inexpensive Tool Used in a Drill Press the Same as a Drill for Pointing Rod Ends

Wedge-Clamp Jig Helps Speed Up Production

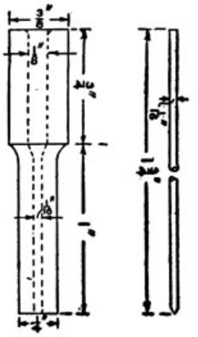
Holes in small, thick pieces must be drilled rather than punched for accuracy, even when produced in large numbers. Much of the cost of drilling is represented by the time necessary to clamp the part securely in the jig, so that the holes will be accurately placed. The jig illustrated enables the piece to be inserted as rapidly as in a punch-press die. In the piece to be drilled, the dimension to be made accurate was that between the two small holes, the center hole being left rough. Instead of having an ordinary jig, where the part must be laid between gauge pins and lifted out vertically when it is finished, the piece



Method of Clamping Employed Enables Operator to Insert and Remove Piece Faster than in Conventional Jig is merely shoved in on a flat surface against stop pins, and is clamped down by a lever operating a wedge-shaped plug which fits the center hole. The lever can be operated by the left hand as the drill-press lever is worked with the right.—John Havekost, New York City.

Combination Center and Circle Punch

After drawing the desired shape on blanking dies it is usually the custom to drill a series of holes inside of the line as close together as possible and then break out the scrap. In laying out the holes, I found the combination center and circle punch more convenient than the dividers. The drills most used for drilling the holes are ¼ in. in size, and to make the combination for this size, a ⅜-in. drill rod was turned down to ¼ in. on one end, whereupon a 1/16-in. hole was drilled through its center and enlarged to ⅛ in. at the upper end, as shown. This prevented any interference with the burr caused by constant hammering on the punch.



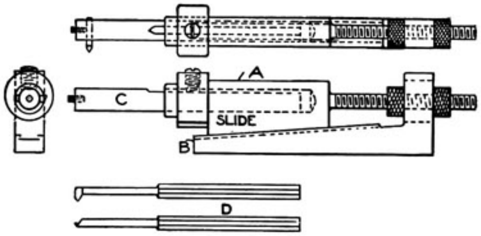
A piece of 1/16-in. drill rod was placed in a lathe chuck and tapered on the end to the desired angle for the center punch. Then it was cut off so that it was about ¼ in. longer than the circle punch. Both punches were then hardened for about ½ in., on their working ends, and then drawn to a medium-dark straw color.

The circle punch was used to mark off the die, leaving the required distance from the die outline and enough space between each circle to prevent the drill from breaking out into the hole just drilled beside it. After punching the circles into the die blank, the punch is fitted into each circle and the center punch inserted and driven to mark the center of the hole.—F. W. Shrier, Pittsfield, Mass.

A Lathe Boring and Threading Tool

A boring and threading tool, suitable for both large and small work, is shown in the sketch. It consists of three main parts, the tool holder, A, the base, B, and the tool, C. The holder and base are attached together with a dovetail slide, which is on an angle with the center line of the tool, making it possible to change the height and at the same time always keep the tool parallel with the hole being bored or threaded.

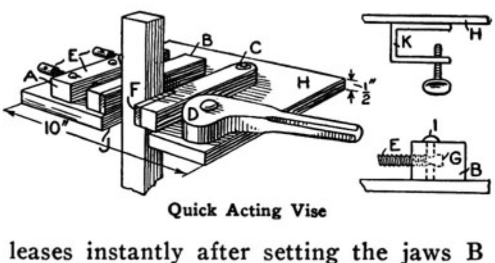
In the rear end of the base an oblong hole is provided in which the threaded end of the tool holder can slide, and two knurled nuts are fitted on the threads for the adjustment of the height. If used for large holes, the tool can be made as shown, where the smaller tools are inserted in the end of C and kept in place by the setscrew. If the work is to be threaded to the bottom of the hole, or the hole is too small for the tool, the part C may be changed for a forged tool, D, fitted in the hole in A and held to the desired length by the setscrew.



The Whole Length of the Tool Is Raised or Lowered on a Parallel with the Hole

Vise for a Drill Press

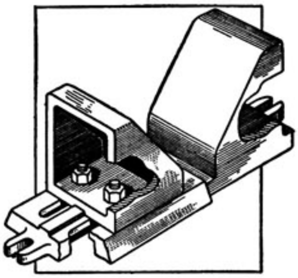
When a number of bars of a uniform size are to be drilled, the vise shown in the sketch is a great time saver, as one movement of the lever D tightens or releases instantly after setting the jaws B and C to the right size by the screws E which turn in the piece A. The pieces A, B and C should be 8 in. long and 1½ in. square. The pieces B and C are fitted with steel jaws F. The piece A is riveted to the base plate H. The ends of the screws E have grooves turned in them to admit a part of the rivet I so that the jaw B may be moved either way with the screw. The clamp K is attached to H so that the whole device can be quickly fastened to the drill table.—J. W. Verner, Boston, Mass.



Quick Acting Vise

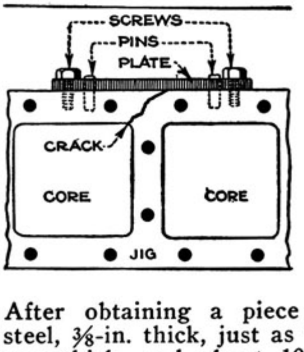
An Adjustable V-Block

The V-block shown in the accompanying drawing has been found to be a very convenient accessory when cylindrical work is set up on metal-working machines, as it is easily adjusted to accommodate work of different diameters. This block consists of a base which is bolted to the machine table by means of the end lugs, and an adjustable jaw which is kept in alinement by the tongue-and-groove arrangement shown. When it is desired to open or close the block, the two bolts that clamp the adjustable jaw to the base are loosened, the adjustment made, and the bolts tightened; these bolts should be made with square heads to fit the slot in the base, to prevent turning.



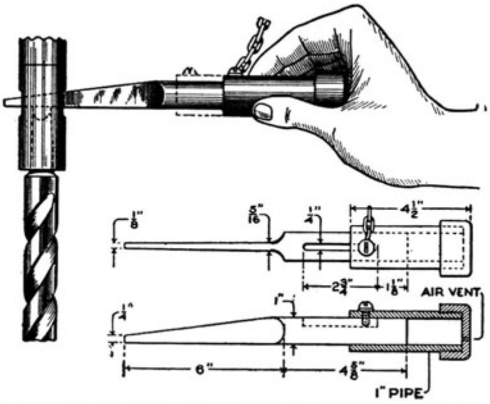
Repairing a Cracked Jig

In repairing a cracked drill jig for a large marine-motor crankcase, it was found impossible to use clamps to pull it together and therefore the repair was accomplished in the following way: The crack was first cleaned thoroughly, which was done by flooding it with gasoline and blowing it out with compressed air. After obtaining a piece of cold-rolled steel, ⅜-in. thick, just as wide as the jig was thick, and about 10 in. long, two screwholes were drilled near the ends and just inside of them two dowel-pin holes as shown. The surface of the jig was laid off and drilled to correspond, allowing 1/16 in. additional space between the holes to allow for the crack. Holes were then drilled and tapped in the jig to correspond to the screwholes in the plate. The plate was heated until it had expanded so that its holes were directly in line with the holes in the jig, and the pins and screws then driven in. As the plate cooled, its shrinkage closed the crack so tightly that it could hardly be seen.



Drill Tool for Easy Removal of Taper-Shank Drills

One of the most aggravating of shop practices is the removal by the ordinary methods of a taper-shank drill that has become wedged in the socket of a drill press. Such drills may be readily removed, and with slight effort, with the aid of the homemade drift tool illustrated. The tapering wedge is made from a piece of shaft steel of the dimensions indicated. The pounding member is a length of pipe and a pipe cap, combined with the wedge part as shown. A length of chain secures the tool in a position always handy to the drill press. The wedge is inserted in the slot at the base of the shank hole and one or two blows with the sliding handle is usually sufficient to dislodge the most stubborn drill.—C. S. Springer, Detroit, Michigan.

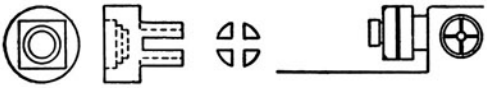


Taper-Shank Drills That Stick in Drill-Press Socket Quickly Removed by a Few Taps with Drift Tool

Jig to Thread Pipes in a Bolt-Cutting Machine

Machine shops are frequently equipped with bolt threaders but have no provision for threading pipe in any other way than by hand. The simple jig shown can be easily made and will do the work with but little special preparation. It consists of a metal block provided with a square opening at one end, to fit the pipe dies, and countersunk so that the pipe can enter far enough for the standard length of thread. The back end of the block is turned to fit the inside of the regular bolt-cutter chuck, and slotted to match the dies, any size answering the purpose.

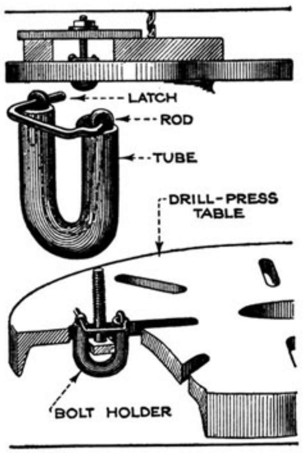
In using the jig, it is put into the chuck with the slots slipped over the dies. It is best to protect these with strips of copper placed in the slots. The required pipe die is put in place in the square opening at the front end. The pipe is held with the vise, and threaded in the same way as a bolt. In backing off, either the machine may be reversed or the die withdrawn and unscrewed with a wrench.—F. W. Bentley.



The Jig as It Is Attached in the Chuck of the Bolt-Cutting Machine to Thread Pipes

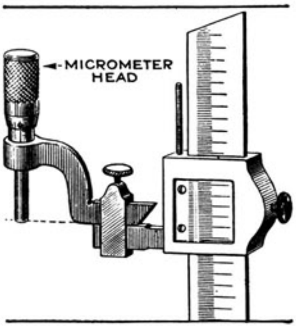
Drill-Press Bolt Holder

he holder shown in the illustration is handy when using bolts in the plain slots of a drill-press table. It not only keeps the bolts from turning when the nut is tightened, but also prevents the bolts from falling to the floor when the nut is removed. Some wire and a length of tubing are the only materials necessary to make it. The tube is bent to the U-shape shown, but before doing so, a length of wire is placed in it; after the tube is bent this wire is looped over at both ends. A latch is next made of the same size wire and attached, care being taken to leave the eye large enough to allow the latch to swing in and out of the opposite loop. When using the holder, the U-shaped wire is pushed through the slot in the table with the latch thrown back. To lock the holder, and to keep the bolt in position, the latch is swung around and pushed through the wire loop. Where it is necessary to use a bolt continually in a plain slot, considerable trouble can be avoided by using this holder, as with it a bolt can be held just as easily in a plain slot as in a T-slot.



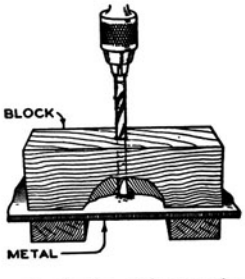
Micrometer Attachment for Height Gauge

In checking a drill jig that had a number of holes in line with each other, I found that a quick method of discovering errors in the location of the holes was to use a micrometer attachment on a vernier height gauge. The micrometer head is fitted into a steel bracket, shaped as shown, and clamped to the gauge in place of the regular blade. When the micrometer thimble is at zero, the end of the spindle is exactly in line with the top of the gauge jaw, thus eliminating any additional calculation. A standard pin is fitted in the first hole, and the height gauge is set so that the micrometer spindle touches the top side of the pin. The reading of the thimble is carefully noted. Having the correct height established in this way, the pin is set into the next hole and the height gauge is slid along so that the micrometer spindle is located above the pin. The spindle is then turned down against the top side of the pin as before. If the reading is the same in both cases the holes are in line; if not, the amount of error is at once apparent. In this way all the holes can be carefully measured.—Alexander Malcolm, Providence, R. I.

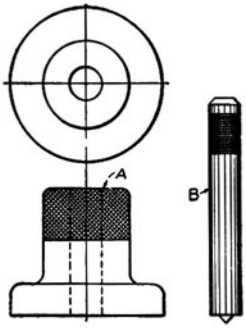


Reducing Breakage of Small Drills

The breakage of small drills caused by too great downward pressure in drilling, can be largely reduced. A wooden block, of sufficient thickness to allow the drill to extend through the underside, is drilled; this is then laid on the work, as shown in the drawing. The block will serve not only to absorb most of the side strain but also to steady the drill.



Tool for Enlarging Center Punch Marks

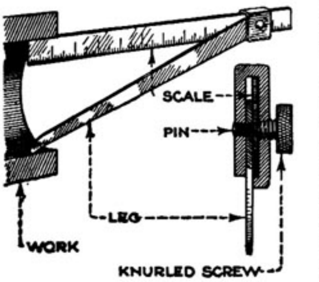


In laying out a series of holes it is a difficult task to make a punch mark large enough to start a drill and also keep it central with the laying out lines. This is especially true when the holes are so small that they cannot be laid out by drawing a circle with a divider.

The accompanying sketch shows a simple little tool for enlarging the center mark and also keeping it exactly central. Locate your center by making a very small dot with a prick punch or scriber. Now place the punch B in the holder A letting it extend through far enough so you can see when the point is centered on the small prick punch mark. Drop the holder A until the base lies flat upon the work and while holding it securely hit the punch B a blow with a hammer. This will enlarge the center mark and also keep it central with the first one.—Chas. E. Klink, Lemoyne, Pa.

Caliper Attachment for Scale

By attaching a caliper leg to a 12-in. scale a tool is obtained that can be used to test whether or not a long hole has been bored straight. Every mechanic knows that a slight taper in a long hole is easily overlooked when calipers are used to measure the diameter, and also, unless the bore is large enough to admit the hand, it is sometimes impossible to gauge the bottom end of a blind hole at all. A 12-in power-hacksaw blade, ground to shape, makes an excellent caliper leg, and can be attached to a scale of the same length in the manner illustrated by the drawing.



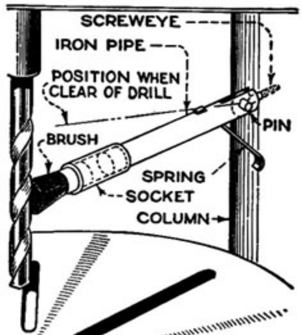
Bend a piece of $\frac{1}{8}$-in. flat steel, and drill one side for a tight-fitting pin, which projects inside and serves as a pivot for the saw-blade leg. A hole is drilled and tapped on the opposite side for a knurled screw with which the attachment is clamped to the scale.

The caliper is set to the proper dimension by means of another scale, and as the leg is opened the holder is pushed forward to keep the caliper point in line with the end of the scale. In use, the tool is pushed into the bore, with the scale held firmly against one side of the hole. Any variation in size can then be felt immediately as the caliper is moved forward. In addition to being handy for long holes of medium diameter, the tool is also useful for larger holes of short length which must be perfectly straight.

Cleaning Drill Flutes

When drilling deep holes in metal, considerable trouble is encountered in keeping the flutes free from chips. The small hand brush usually used for this purpose is unsatisfactory, owing to the difficulty of holding it rigidly against the drill when the latter is revolving. To overcome this, the rigid brush holder shown in the illustration has been found satisfactory.

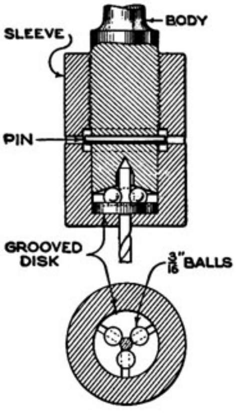
The handle of a stiff, round bristle brush is sawed off, leaving only the portion that holds the bristles. This portion is screwed into a pipe socket, and a short length of pipe is screwed into the other end of the socket. The pipe is slotted at the opposite end, to fit over a screweye in the drill-press column; a pin passing through both holds them together. To complete the job, a flat or round-wire spring is pushed through small holes or slots cut in the pipe a short distance from the end of the slot, as indicated.



The length of the whole arrangement is such that it will force the brush to dig well into the flutes when the pipe is at right angles to the drill. When using, the operator presses lightly down on the pipe each time the drill is withdrawn from the hole. This forces the bristles into the flutes and clears them of chips. As soon as the pressure on the pipe is released, the spring forces the brush up and away from the drill. The brush can, of course, be screwed in and out as desired, to adjust for wear and for various sizes of drills.

Ball-Grip Drill Chuck

A drill chuck for holding small drills up to ⅛ in. in diameter is a convenient article of shop equipment, but one not always at hand. The chuck shown in the drawing can easily be produced in the average small shop, as it has no intricately shaped parts.

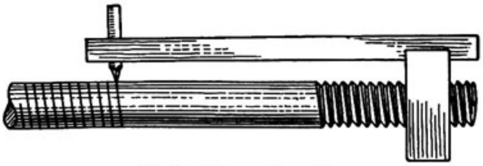


The body is made of ¾-in. cold-rolled round stock, is turned on the shank to suit the drill-press spindle, threaded, drilled with a long-pointed ⅛-in. drill, and drilled for a stop pin, then beveled as shown, the completed piece being casehardened. Three 3/16-in. steel balls are required, as well as a disk with three radial grooves, about 1/16 in. deep, for the balls to rest in, and to keep them equally spaced. The sleeve is bored out to accommodate the grooved disk, which has the same outside diameter as the body, is tapped to fit the threaded portion of the body, and recessed to clear the stop pin. This pin is necessary to prevent the sleeve from being screwed too far down, and allowing the balls to slip out of their grooves.

Marking Threads on a Bolt

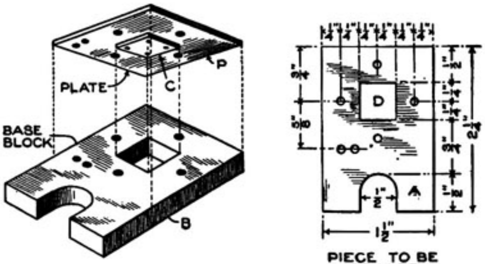
Some bolts had to be shortened about 3 in. in repairing a steam pump located a long distance from a machine shop. The threads varied in size, owing to the bolt sizes, and the length cut off from each bolt would remove the threaded portion, thus making it necessary to cut new threads on the shank of the bolts.

The only tools at hand were a vise and some small files and the threads were cut in the following manner: The nut was placed on the end of the bolt and given a turn on one thread. A piece of board was notched out to fit on the nut and a hole made through the other end by driving in a nail and drawing it out. A pencil was put in the hole and the bolt was rubbed with chalk and then, by turning the nut and wood strip, it marked the thread wanted. The old thread was cut off and a new one filed in with a three-cornered file.
—Arthur L. Kerbaugh, Allentown, Pa.


Marker Fastened to Nut

Drill Jig for Formed Flat Pieces

A number of thin, flat pieces, shown in detail at A, were to be drilled. At the left of the diagram is reproduced the drilling jig whereby the holes were drilled accurately in the locations specified. The drilling was done as follows: The piece A was laid on the base block B which rested on the table of a drill press. The plate P was placed over them. The square boss C, riveted to the lower surface of the plate, served to center the piece accurately between the plate and the base block. The drill was forced successively through each of the template holes in the plate. For the plate P, a flat piece of machine steel, 3/16 in. thick by 1½ in. square, was utilized. The boss C was finished to make a good fit in the square opening machined in the base block to receive it. After the drill holes had been laid out and drilled in the jig it was casehardened, which tends to prevent enlargement of the holes due to wear. When drilling the pieces, one drill is first used to locate all the holes. Then such holes as are to be of a greater diameter can be drilled out to the larger size in a subsequent operation.



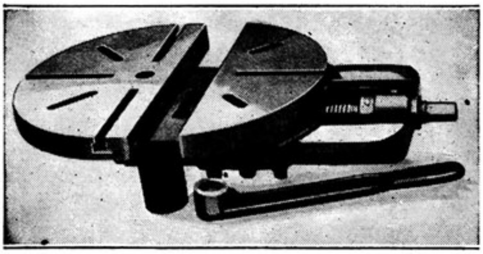
DRILL JIG

PIECE TO BE DRILLED

Parts and Dimensions of Jig Constructed for Drilling Thin, Flat Pieces

Combination Table and Vise Fits Any Drill Press

Of interest to machinists is the recent marketing of a combination vise and drill table which can be readily attached to any drill press. The entire unit is designed to fit into the socket formed for the regular table, and is made to swivel in the same manner. The attachment is said to save considerable time in drilling operations, as the worker does not have to hunt up a separate vise for clamping his work to the table. An additional advantage is that when the vise is open, it forms a split table so that projections on the work piece can be placed in the opening. For convenience in making replacements, the vise jaws have been made both removable and interchangeable, avoiding the trouble of refitting.



A Combination Drill Table and Vise: When Closed, the Vise Forms a Table

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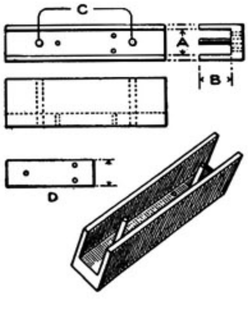
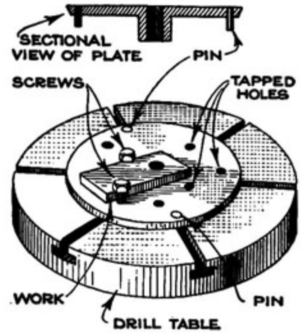
Jig for Drilling Small Sheet-Metal Pieces



Where a large number of small, thin, square or rectangular pieces of sheet metal or brass, having in them one or more holes, are to be drilled, an effective jig can be constructed with little work from a block of steel, as shown in the illustration. In using this jig the pieces to be drilled are piled in the groove of the block. A finished piece, D, which serves as a template to locate the holes accurately, is placed on the top of the others when the contrivance is being used. In width the block should be equal to the dimension A plus ¼ in. Its length should be such that it can, when in use, be held securely and safely by the hand. The slot is milled of such a width that the pieces which are to be drilled can be placed in or taken out of it easily. However, it should not be too wide because this would impair its accuracy. The depth, B, should be such that several pieces can be accommodated and drilled simultaneously. Two guide pins, C, driven in drilled holes, prevent longitudinal motion of the pieces.

A Handy Drill Plate

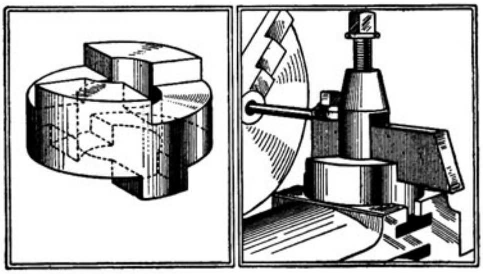
Many times work is drilled on a heavy drill press because there is no sensitive drill available, or because the work requires clamping to the table. In such cases, and a variety of others, the drill plate illustrated can be placed on the table of the heavy drill press, clamping the work, and saving the table from becoming pitted when the drill breaks through the work. The plate is made of cast iron, and the shank is turned to fit the hole in the table, the outside diameter being tapered slightly, to facilitate the removal of the plate. Two pins are driven into the plate, engaging the T-slots of the table to prevent the plate from turning, and a ½-in. hole is drilled through the shank. As the plate is cheaply made, holes can be tapped in any position desired, and when its surface becomes too deeply pitted, the plate can be scrapped and a new one substituted. Hexagon screws with larger heads than standard are handy as clamps, as they not only prevent flat pieces from flying around when the drill breaks through, but also stop the work from climbing up the drill, as it very often will if only a pin or stud, set into the drill-press table, is used as a stop.



Boring-Tool Holder

On jobs requiring the use of a long boring tool, it is important that the tool be very firmly held in the tool post, as the pressure on the cutting edge has a long leverage to force the tool back from the work. On such jobs it is also especially important that the tool be held exactly parallel with the spindle.

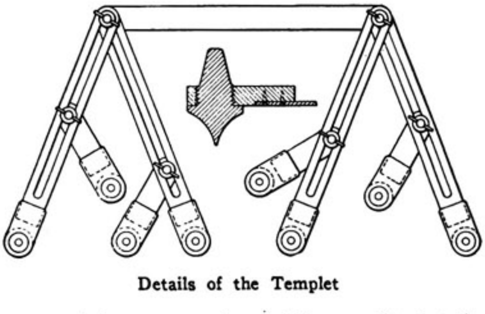
The device, detailed at the left, and illustrated in use at the right, gives a positive grip on the tool so that even if the tool-post screw should become slightly loose, the tool will continue to cut. The piece is shaped from either cast iron or mild steel, and the recesses are milled in its top side, the bottom having a tongue to fit the T-slot.—M. L. Lowrey, Livermore, Calif.



A Metal Block Takes Most of Strain Off Tool-Post Screw When Using Long Boring Tool

Tool for Transferring Holes

Machinists and repairmen often have occasion to transfer a set of holes from one piece of metal to another, a difficult task unless one has the proper templets. The little tool shown in the accompanying sketch was devised for this work and has proven very satisfactory. Simply loosen the thumbnuts and let the different points and arms conform themselves to whatever position the holes may be in, tighten the nuts, set the instrument on the work with the sharp points down, and tap each one a slight blow with the hammer. If the end points are marked first they will tend to hold the tool in place while the others are being marked. It is a universal tool as it can be used for any number of holes up to eight at one time. The small sketch in the center shows the detail construction of the punches and end plates. The points of the punches should be hardened.—C. G. Smith, Brooklyn, N. Y.

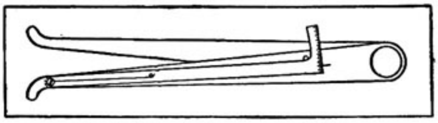


Details of the Templet

An Attachment for Inside Calipers

Many times in difficult places it is impossible to find the largest diameter of a hole with common inside calipers. The device shown in the sketch is simple, accurate and easily constructed for use in finding the largest diameters of holes. The foot is cut from one side of an ordinary inside caliper and the graduated arm with a foot, as shown, is pivoted in its place. A very light spring is soldered to the head of the rivet or screw and its extending length pressing against a pin located on the arm keeps the arm at zero on the scale. The graduations mean nothing more than marks to note the position of the arm while making the measurement.

The main object of this device is that the spring will cause the attached arm to find the largest diameter of the hole and will not measure to one side.

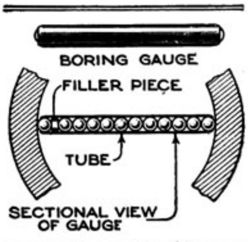


For Finding Diameters of Holes

The graduations may be made to suit the operator. A test indicator could be clamped to one leg of the caliper with the same result.

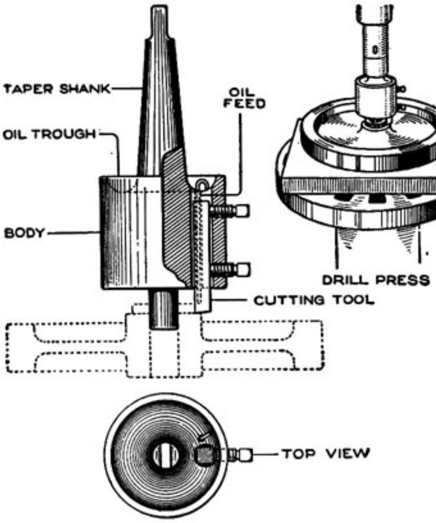
A Simple Boring Gauge

The drawing shows a gauge that is very useful on boring work, as it is cheaply made, accurate, and worn parts are easily renewed. A piece of tubing is cut a little shorter than the diameter of the hole to be bored, and both ends of it are turned over to retain the balls with which it is filled. One end of the tubing is slotted so that the balls can be sprung in or out. As steel balls are made to limits of .0001 in., the possible error will be very small. If the gauge is a long one, greater accuracy can be obtained by carefully selecting the balls, calipering each before using. Of course, such a gauge will ordinarily measure in dimensions that are multiples of the diameter of one ball, but, by using a filler piece in the manner shown, other sizes can be measured as well.



Tool for Machining Bosses and Hubs on Drill Press

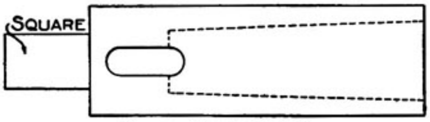
Bosses and hubs for all manner of light machinery may be machined on a drill press by the adoption of a taper-shank cutting tool as shown in the illustration. Best results are accomplished in this work if the press is operated at its lowest speed. For machining bronze, aluminum, or soft castings, no oil is needed, but for any work harder than the best grades of gray iron a continuous oil bath through the top of the tool is essential to retaining a keen edge.



Equipped with This Tool, the Drill Press Machines Bosses and Hubs Accurately

A Socket for Ratchet Drills

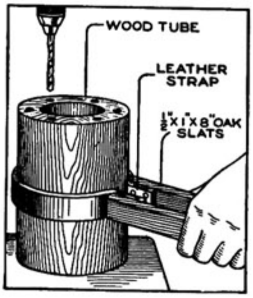
As nearly all ratchets are made with a square driving hole, the drills used in them must have square shanks. This means keeping a large stock of the square-shanked drills on hand or forging a shank on a twist drill, which operation usually spoils the tang of the drill. If a socket is made like the one shown in the accompanying sketch, this trouble is overcome. One end of the socket is bored to a Morse taper and the other end has a square shank that will fit the ratchet. By the use of this socket and the regular sleeves, most any sized twist drill can be used. This affords a saving of much time when a number of different-sized holes are being drilled.—D. A. Hampson.



Square Shank Socket

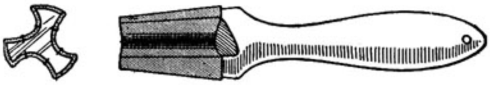
Handle for Holding Polished Round Stock for Drilling

In a large factory a rush order was received which called for countersinking several holes around the top edges of a large number of wooden cylinders. As the tubes were polished and varnished they were difficult to hold while drilling. This difficulty was overcome by the use of the simple gripping fixture illustrated. The strap is made just long enough to allow a little space between the handles when they are grasped firmly.



Cleaning Stick for Machine Spindles

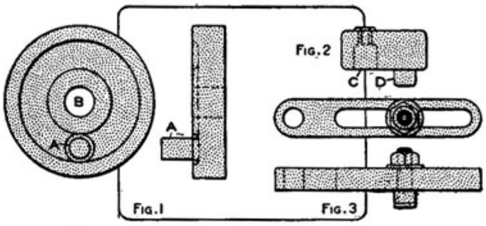
The usual method of cleaning hollow spindles for centers or drills is to use waste, frequently wound around some handy article such as a file. A better and safer method would be to use a tapered stick, notched as shown, and covered with a layer of felt. As this fits the spindle hole closely, a thorough job of cleaning is done, and the accumulated dirt is brushed off into the notches, thereby preventing any scratching or grinding as often results with waste and a file.—John Harger, Honolulu, H. I.



The Notches Catch the Dirt as It Is Loosened from the Center Bore

Adjustable Jig for Drilling Radial Holes

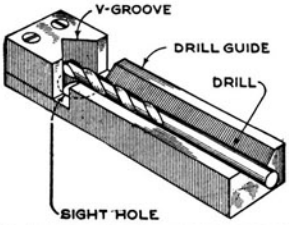
When a number of radial holes are to be drilled accurately in pulleys, or similar machine parts, the jig shown in two forms in the sketch will be found convenient. It was devised for the drilling of holes in a boss, A, as shown in Fig. 1. The jig shown in Fig. 2 was made of a piece of cast iron, drilled at C to fit the boss, and provided with a tempered-steel collar to guide the drill. The lug D was provided to fit into the hole B, as a guide in drilling the hole in the boss. An adaptation of the jig, which may be adjusted for various sizes of pulleys, or other radial drilled work, is shown in Fig. 3. If holes of various sizes are to be drilled, bushings may be fitted into the guide hole at the end of the jig.—C. Anderson, Worcester, Mass.



Radial Holes in Pulleys, or Similar Machine Parts, May Be Drilled Accurately by the Use of This Jig

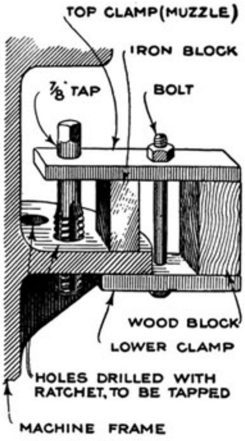
A Handy Drill Gauge

The drawing shows a form of drill gauge that has the advantage of indicating at once whether the drill has been ground central and to the correct angle or not. The gauge is made in two pieces, the drill guide being made from ½ by 1-in. stock, with a V-groove cut the entire length. One end of this guide is milled down to about the depth of the V-groove, as a seat for the V-block into which the point of the drill fits. The sides of the V-block are cut to the same angle as a correctly pointed drill—118°, including angle. A hole is drilled just underneath the slot in the end block, the latter being fastened to the guide by two screws. By placing the drill in the position indicated, any irregularity in grinding will be readily discerned by holding the gauge to the light and observing whether or not light can be seen between the drill and the edge of the groove in the block.—Harry Moore, Montreal, Que.



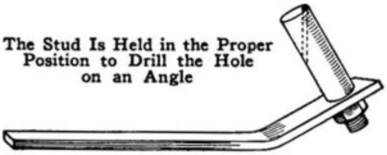
Clamp Aids in Tapping Drilled Holes

While erecting some heavy machinery, I encountered some few holes which had not been tapped by the builders of the machine. These holes were in a flange, which ran around part of the body beneath an overhanging portion, so that a tap wrench could not be used. To turn in a ⅞-in. tap with a monkey wrench and make the tap run straight was more than the builders had cared to do. The way I turned the trick was to bolt a muzzle clamp on the shank of the tap, as shown in the drawing, which served as a guide. The hole in the muzzle was drilled a few thousandths of an inch larger than the diameter of the tap shank, and oil was used liberally on both the shank and the threaded part.—J. V. Romig, Allentown, Pa.



Drill Jig for Drilling Slanting Holes in Studs

Where it is necessary to drill a hole at an angle in the end of a stud for an oil passage to the grooves in the bearing, the drilling is quite difficult, unless some sort of jig is used. The illustration shows a very simple jig for this work, it being made of a piece of metal of sufficient strength for the work, bent in the shape shown.

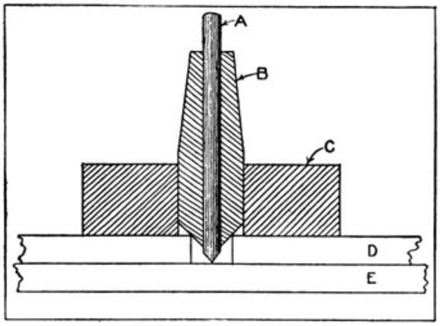


The Stud Is Held in the Proper Position to Drill the Hole on an Angle

The jig can be fastened to the platen of the drill in the desired position for drilling the hole.—Russell E. Hollis, Chicago, Ill.

How to Make a Self-Centering Punch

The device consists of a ¼-in. pin, A, fitted snugly in a sleeve, B, which is tapered short on one end and long on the other. The sleeve, B, is made a close fit in the collar C. When the collar, C, is placed over a hole as in plate D, the sleeve, B, will adjust itself so the center punch, A, will be exactly central in the hole drilled in D. Strike the center punch, A, a light blow to mark the plate E. A light blow is necessary so the device will not be thrown out of center.

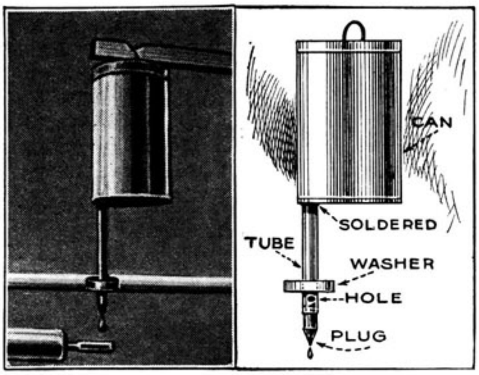


Details of the Punch

This device will easily mark the center of the holes to be drilled in E that will coincide with holes in D. This will beat the old method of using a scriber and dividers to locate the center.—C. G. S.

A Simple Drip Can

The drip can shown in the illustration has been used for a considerable time for supplying oil and cutting compounds to taps used in a tapping machine, and has been found to give as much satisfaction as any device on the market.

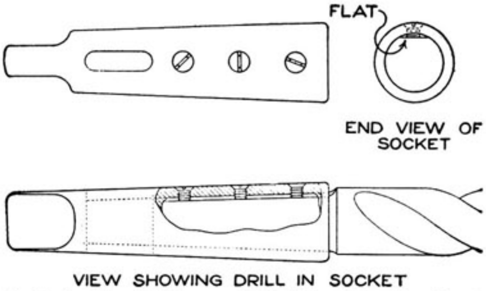


Simple Drip Can for Supplying Oil and Cutting Compounds to Taps in a Tapping Machine

It is made by piercing a hole in the bottom of a tin can and soldering a short length of copper tubing into this hole. A wooden plug, pointed at one end, is driven securely into the lower end of the tube, and a small hole is drilled in the tube just above the plug. The amount of liquid flowing out of this hole is controlled by covering the hole more or less with a leather or rubber washer that slides snugly on the tube.

Sockets for Broken-Shank Drills

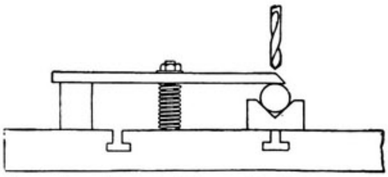
When a drill shank is twisted off it is usually thrown away and a new one milled, or else some special socket must be provided to drive it. With but very little change, a regular socket can be used to drive such drills without spoiling its service for drills regularly provided with shanks. For this purpose, several holes are drilled and tapped in the socket to fit slotted, headless or flat-head setscrews. The twisted-off drill is ground to provide a flat bearing for the setscrews. When inserted in the regular socket, it can be securely held in place by the setscrews provided with flat bottoms, which are screwed against the flat place on the drill. —J. V. Romig.



A Socket for Holding a Drill That Has Its Shank Twisted or Broken Off

Spring on a Faceplate Clamp

The ordinary clamp for holding work on a faceplate may be easily fixed to lift its jaw automatically from the work when the nut of the bolt is loosened. All that is necessary to make this possible is to place a coil spring over the bolt beneath the jaw, as shown in the illustration. The spring also keeps the jaw from turning or changing its position when the nut is released.—N. C. Danielson, Moline, Ill.



The Clamp Jaw Is Raised from Its Holding Position by a Coiled Spring around the Bolt

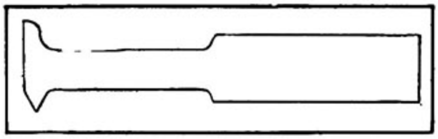
¶Grease or vaseline, rubbed on the hands before starting on a dirty job, will keep the dirt out of the pores, and enable the hands to be cleaned much more easily afterward.

How to Make Drill Bits and Boring Bars

Combined Boring and Threading Tool

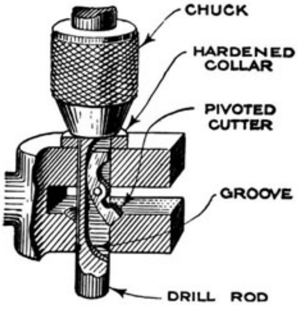
The illustration shows a combination boring and threading tool that may be used to good advantage on some kinds of work.

The back part of the tool, of which the sketch is the top view, is ground to be used as a boring tool with the lathe running backward, and the front part for threading. If a number of articles are to be bored and threaded by using a common lathe it is necessary to have two tools and make two settings for each piece, and caliper the thread and hole for each one chased and bored. Two stops are used for the tool slide, one in the back and one in the front. This makes it only necessary to be sure the first is right and the others will be duplicates. The stop for boring was made so it would swing back; when the hole is bored to size, it is undercut at the back to allow the thread to run out. This tool is especially adapted to brass work.



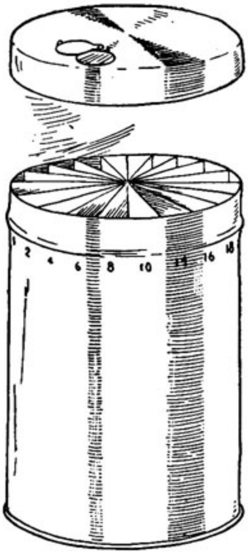
A Tool for Internal Countersinking

The tool shown in the drawing has been successfully used to countersink a hole where it breaks into a slot at right angles, and suggests a principle that could be satisfactorily applied to a variety of internal work. The shank is made from cold-rolled steel, case-hardened, and is slotted to take the pivoted steel cutter. On entering the hole in the work the upper projecting end of the cutter is forced back. This brings the lower end out into the slot and the countersinking operation is done as shown. A hardened collar serves as a stop, to regulate the depth of cut and prevent the cutter from digging into the work.



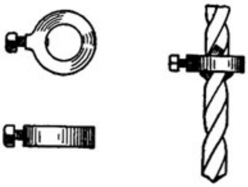
A Twist Drill Box

Small twist drills are apt to become lost or mislaid when not in use, if they are not kept in some special box or place provided for that purpose. A handy and easily made box for holding them is shown in the accompanying sketch. Secure an empty baking powder box and solder as many partitions in it as you have different sizes of drills. Make a hole in the lid, close to the edge, large enough to accommodate the largest drill. Now when the lid is in place on the box this hole can be turned to any desired compartment and a drill removed from it. A slide can be made to fit over the hole as shown. Each compartment of the box should have the size of the drill it contains stamped on the outside.



Counterbore Attachment for a Twist Drill

The attachment can be used on a twist drill for countersinking the hole when it is drilled through the metal, or be set to make the countersink when the drill reaches a certain depth. The attachment is made of a piece of cold-rolled steel, drilled through its center larger than the drill upon which it is to be applied. Two pieces of tool steel are ground to fit the flutes on the drill and of sufficient thickness to form cutters for the size of the countersink. The cold-rolled steel can be shaped as desired, but it is always best to have a piece large enough so that a flush screw can be used for safety. The attachment can be set on the drill at any point desired.



A Tool for Drilling Square Holes

A three-cornered drill that bores square holes and that can be used on any lathe, drill press or milling machine is one of the improvements in mechanical tools. This tool will have a wide field of application in wood, stone and metal-working materials. The time occupied by usual methods of cutting square or angular holes is so great as to bar their use except on expensive work, but when using the new drill a square hole can be bored nearly as rapidly as boring a round hole with a twist drill.

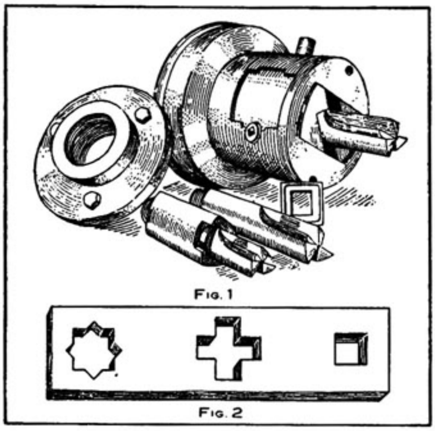


Fig. 1

Fig. 2

Chuck and Drill for Boring Square Holes

With a little change of the drill, triangular holes, and holes with five, six or more sides can be bored as desired. The device for doing this work consists of a special drill, three-cornered for making square holes, and a special chuck for holding this tool which is fixed on the ordinary lathe or drill press. This chuck contains three parts that move independently of one another. First, a part that screws on and revolves with the spindle of a lathe or drill; second, a stationary part which rides on the first part, and third, a holder into which the shank of the drill is screwed. This holder is caused to rotate with the first part, but is at liberty to move sidewise a certain distance in any direction. The exact motion is determined by a guide in the second part of the chuck which surrounds the shank of the drill.

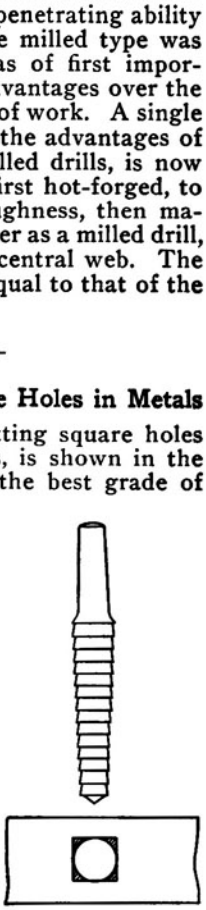
The shank of the drill is three-cornered, but not exactly triangular—that is, the three sides are convex, being formed by arcs of circles struck from centers at the opposite corners. The three-cornered shank just fits into the square guide and as the shank turns around in the guide which is held stationary the three corners of the shank in turn enter into each of the four corners of the guide. At the same time the three corners of the cutting head strike out the sides of the work. The cutting edges are on the end of the tool. The drill and chuck are shown in Fig. 1 and some holes that can be bored with the tool are shown in Fig. 2.

Drill Combines Strength and Accuracy

High-speed twist drills have in the past been made by two processes, forging and milling. The forged drill was used wherever great strength and penetrating ability were required, while the milled type was used when accuracy was of first importance. Each type had advantages over the other for certain classes of work. A single type of drill, combining the advantages of both the forged and milled drills, is now available. The drill is first hot-forged, to insure strength and toughness, then machined in the same manner as a milled drill, to produce an accurate central web. The cutting quality is thus equal to that of the forged drill.

Tool for Cutting Square Holes in Metals

A special tool for cutting square holes in iron, or other metals, is shown in the sketch. It is made of the best grade of tool steel with the body square and tapering and teeth cut, as shown, the top one being the size of the required hole. As accuracy in graduating the thickness and pitch of the teeth is of great value, it is advisable to cut them in a machine, although it can be done by hand with a file. In tempering the tool, be careful to secure an even hardness throughout. To cut the square hole, first drill a hole of the same diameter as the sides of the square hole desired. Hold the iron over the open jaws of a solid box vise, an anvil hole or a dressing plate, and insert the cutter, then, with a few blows of a hammer, start the cutter, which takes the corners out gradually as the tool penetrates the hole, the material removed dropping from the hole until finally the cutter



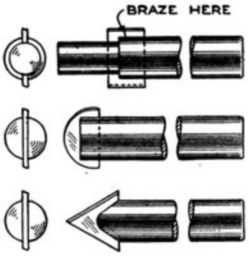
passes through, giving it the desired dimensions.

In order to prevent the cutter from heating and to insure a smooth cut, it is advisable to dip the cutter in oil before using it. To protect it from striking the hardened surfaces of the vise jaws, pieces of hardwood should be used on the jaws.

With a properly made tool, round holes in iron, ½ in. thick, can be made perfectly square quickly. Holes of other shapes, oval, triangular, pentahedral, hexagonal, etc., can be cut successfully by using a tool made on this principle.—Pierre Wagner, Indianapolis, Ind.

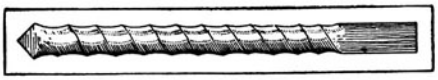
Counterbores for Light Work

Counterbores and countersinks for very light work may easily be made of pieces of broken hacksaw blades and scraps of steel rod. The accompanying drawing shows three such tools. The end of the rod, in the upper one, is turned down to act as a pilot, the rod is then slotted, the cutter inserted and brazed into place. The other two tools are countersinks of different form; to make these, simply slot the rod end, insert the scraps of blade, braze and then grind to shape. It is well to insert the blade as far as possible, for the sake of strength.—E. A. Telfer, San Jose, Calif.



Homemade Extension Drill

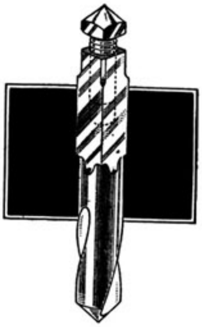
While drilling some castings one day I found that the twist drill was not long enough to reach through each piece. The holes were to be 3/8 in. in diameter. I took a piece of 5/16-in. round tool steel and after heating I hammered it out square and then after taking another heat the square steel was twisted until it had the appearance shown in the accompanying cut. After the twisted rod was tempered and ground to the proper cutting edge it was placed in the drill chuck and used the same as an ordinary twist drill. It is surprising how well this tool will work.—L. N. Fasnacht, Inland, Ohio.



Used Like an Ordinary Twist Drill

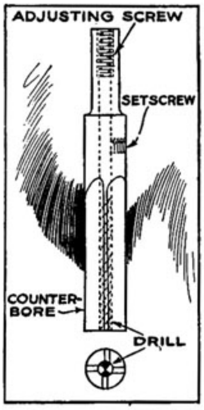
Drill for Use in Small Space

On a repair job, several holes were to be drilled in a space so small that it was impossible to use either a portable electric drill, or any ratchet drill that was available. As immediate action was imperative, the drill shown in the drawing was used. A short drill of the proper size—in this case 23/64 in.—was obtained, a portion cut off the shank, and the shank squared to fit a small ratchet-wrench socket. A hole was drilled and tapped in the end of the shank for a 1/4-in. setscrew, the head of which was turned to form a center. The drill was turned by means of the ratchet wrench, and the feed obtained by unscrewing the setscrew, as with the ordinary ratchet drill.—M. L. Lowrey, Livermore, Calif.



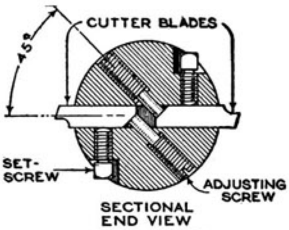
Counterbore for Square-Bottom Hole

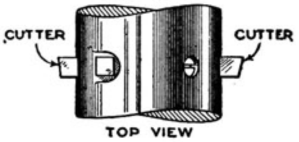
The drawing shows a counterbore that was designed to make a flat-bottom hole in a case where a teat projecting from the bottom of the hole, as left by the ordinary flat-end drill, was not permissible. Usually, with a tool of this character, considerable trouble is encountered in keeping it sharpened, when it is made in one piece, as there is no clearance at the center. In the tool illustrated, a hole is drilled axially to accommodate a small drill, held in place by a setscrew, the thrust and compensation for wear on the drill being cared for by the adjusting screw in the top. It is no great trick to grind a drill to cut a square bottom, and the clearance necessary to grind the body is provided by the axial hole.—John Homewood, Ontario, Calif.



¶Hydrogen peroxide freely applied to the spot will neutralize and remove blood spots from clothes. If applied before the blood becomes too dry, hardly any stain will be left on white goods.

Adjustable Boring-Bar Cutters



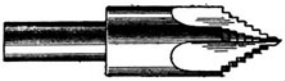


In making cutters for the boring bar of a vertical or horizontal boring machine, the usual practice is to make a transverse hole through the bar, and set the cutter in the squared hole, with a setscrew above, to hold it in place. This method requires that the setscrew be loosened and the cutter tapped forward with a hammer, to increase the depth of cut. A simpler method of setting up the cutter uses a separate adjusting screw, set at an angle of about 45°, as shown in the drawing, a turn of the screw serving to drive the cutter forward an exact distance. With slight practice, the cutter can be moved the desired amount without frequent trials, such as are necessary when moving it an indefinite amount by driving it forward with a hammer.

Apart from the advantage of setting the tool forward small fractions of an inch for making finishing cuts, this method allows two cutters to be used, on opposite sides of the bar. The tendency of the tool to cut smaller at the center than at the beginning of the cut, due to springing, is also avoided.—G. A. Luers, Washington, District of Columbia.

An Original Drill for Sheet Metal

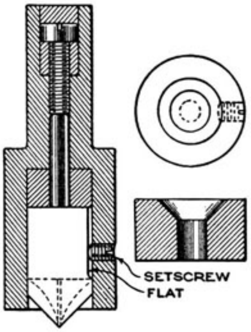
The drawing shows an original design in drills for the particular purpose of drilling holes in sheet metal. It is sometimes dangerous to undertake the drilling of very thin sheet-metal stock with an ordinary drill, and the hole that results is generally very ragged. This drill will make a hole from ⅛ to 1 in. in diameter, each step advancing in size ⅛ in. It would at first appear that drilling, say a ¾-in. hole, with this tool would be a slower operation than with a drill of that size, but this is incorrect, as each succeeding step removes the same amount of metal and permits a quick feed.



The steps are formed on the lathe, and are backed off or relieved on the bottom only, after the flutes have been milled or filed to form the cutting edges. The radii of the cutting edges are left as they come from the lathe, thus assuring a smooth even hole. To operate the tool for cutting a hole of a certain diameter, it should be fed through the sheet stock until the desired size is obtained; then, if several holes of the same size are to be drilled, the stop on the drill press should be set for the proper depth.

An Adjustable Countersink

Where flat-head screws are used in machine work, nothing looks worse than screws countersunk either too deeply or not deeply enough. In the latter case, the projecting screw heads, in addition to their ugly look, may be positively dangerous. It is difficult, using an ordinary countersink, to gauge accurately the depth of the countersink, as even when using a depth stop on the drill press, small inequalities of the surface may cause varying depths. With the tool shown in the drawing, countersinks may be made of equal depth, whether or not the surface is quite true, or whether the work is done on a drill press or with the hand drill.



The main body is made of 1½-in. cold-rolled steel, drilled, tapped, and counterbored at the top for the adjusting screw, and bored at the bottom for the countersink. The countersink has four milled flutes, and a milled flat on one side, against which a setscrew bears. In order to avoid a long adjusting screw, a piece of steel rod is dropped between screw and countersink, as shown. It is advisable to caseharden the end of the body that comes in contact with the work.

Decimal Equivalents of Drill Sizes

The following table gives the sizes in decimals of an inch, of all drills from number 80 to ½ in., and will be found valuable for figuring clearances, driving fits, etc. For example, supposing you want to drill a bearing hole for a ⅛-in. shaft. By using a drill 1/64 of an inch larger the hole would be too large and would allow the shaft to run out of true. A ⅛-in. drill on the other hand would make it a driving fit, as the drill is made a trifle smaller than the nominal size. But by referring to the table it will be found that a No. 30 drill is about .008 of an inch larger than the shaft, which is just about the proper clearance.

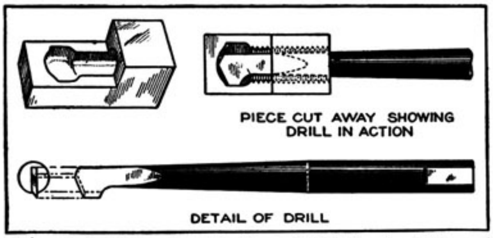
SIZE.	Equival't Decimals of 1 inch.	SIZE.	Equival't Decimals of 1 inch.	SIZE.	Equival't Decimals of 1 inch.	SIZE.	Equival't Decimals of 1 inch.
1-2	0.500	G	0.261	5-32	0.1562	51	0.067
31-64	0.4843	F	0.257	23	0.154	52	0.0635
15-32	0.4687	E 1-4	0.250	24	0.152	1-16	0.0625
29-64	0.4531	D	0.246	25	0.1495	53	0.0595
7-16	0.4375	C	0.242	26	0.147	54	0.055
27-64	0.4218	B	0.238	27	0.144	55	0.052
Z	0.413	15-64	0.2343	9-64	0.1406	3-64	0.0468
13-32	0.4062	A	0.234	28	0.1405	56	0.0465
Y	0.404	No. 1	0.228	29	0.136	57	0.043
X	0.397	2	0.221	30	0.1285	58	0.042
25-64	0.3906	7-32	0.2187	1-8	0.125	59	0.041
W	0.386	No. 3	0.213	31	0.120	60	0.040
V	0.377	4	0.209	32	0.116	61	0.038
3-8	0.375	5	0.2055	33	0.113	62	0.037
U	0.368	6	0.204	34	0.111	63	0.036
23-64	0.3593	13-64	0.2031	35	0.110	64	0.035
T	0.358	7	0.201	7-64	0.1093	65	0.033
S	0.348	8	0.199	36	0.1065	66	0.032
11-32	0.3437	9	0.196	37	0.104	1-32	0.0312
R	0.339	10	0.1935	38	0.1015	67	0.031
Q	0.332	11	0.191	39	0.0995	68	0.030
21-64	0.3281	12	0.189	40	0.098	69	0.029
P	0.323	3-16	0.1875	41	0.096	70	0.027
O	0.316	13	0.185	3-32	0.0937	71	0.026
5-16	0.3125	14	0.182	No. 42	0.0935	72	0.024
N	0.302	15	0.180	43	0.089	73	0.023
19-64	0.2968	16	0.177	44	0.086	74	0.022
M	0.295	17	0.173	45	0.082	75	0.020
L	0.290	11-64	0.1718	46	0.081	76	0.018
9-32	0.2812	18	0.1695	47	0.0785	77	0.016
K	0.281	19	0.166	5-64	0.0781	1-64	0.0156
J	0.277	20	0.161	48	0.076	78	0.015
I	0.272	21	0.159	49	0.073	79	0.014
H	0.266	22	0.157	50	0.070	80	0.013
17-64	0.2656						

Drills Made from Hacksaw Blades

Broken hacksaw blades may be ground into satisfactory drills for boring small holes through thin material or for drilling shallow holes. The steel blade should be broken into short sections and the ends ground to standard sizes not larger than 3/16 of an inch. The point is ground like a straight-fluted drill. The drills may be held securely in a brace having two parallel jaws.

Drill for Enlarging the Bottom of Threaded Holes

The drill illustrated is ground from a piece of tool steel to the shape and size required for the work in hand. After this type of drill has been used, bottoming taps will be found unnecessary. It also permits enlarging the bottom of the hole without the slightest danger to the threaded walls. In a hole thus bottomed, the stud may be screwed in firmly, as there is vacant space all around its end, and once sent home it will have little tendency to back out. — M. L. Lowrey, Livermore, California.



Threaded Holes Are Easily and Efficiently Enlarged at the Bottom by the Use of This Simple Tool

Extension Shank of a Twist Drill

Procure a piece of round stock, a little larger than the drill shank, and drill a hole in one end, about ½ in. deep. File a ½-in. slot, A, to the center, with its edge even with the bottom of the hole. File the shank of the drill B flat for about ½ in.

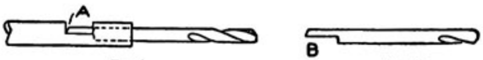


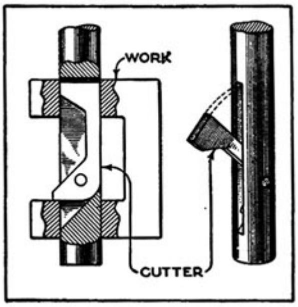
Fig. 1 Fig. 2

Drill Shank Extension

When the drill is inserted, the two flat surfaces will prevent it from turning.—I. W. Verner, Roxbury, Mass.

Counterboring Tool for Inside Faces

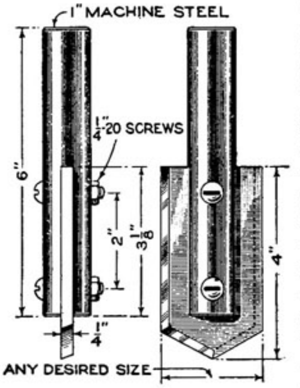
In counterboring an inside face on a piece of work similar to that illustrated, the operation is usually done by using inserted - cutter tools, the cutter being removed after the job is finished in order to permit withdrawal of the tool bar. With the tool illustrated, this is unnecessary, and moreover, there is no need of stopping the machine when withdrawing the bar, as centrifugal force will keep the cutter in the position shown at the right, when clear of the work.



The bar is slotted rather longer than

usual, and the bottom end is finished at an angle, upon which the cutter bears when free. The cutter is made in the form shown, the upper and lower edges being rounded to the radius of the bar, the bottom face, of course, being relieved. The cutter is pivoted to the bar as indicated, and it will be clearly seen that its shape compels it to take an upright position as the bar is advanced, the top part and the pin taking the thrust while cutting.

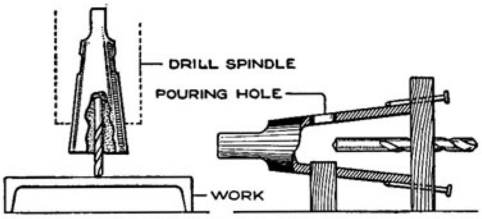
Drill for Slate or Marble



Tile setters, plumbers, electricians, and others must frequently drill holes through hard, brittle tile, porcelain, or slate at no slight expenditure of time and broken drills. The drawing illustrates a drill for such work that is particularly effective for use when large holes are to be drilled. The cutting tools, which are made of tool steel, are removable for sharpening, and can be made for holes of different diameters. The edges are milled off at an angle of about 45°, or enough for good clearance, and the lips are sharpened in about the same manner as an ordinary flat drill, the sides also being sharpened. When a hole is to be drilled with this type of tool, a guide hole is necessary to allow the dust to fall through. Very slow speeds are essential to successful drilling in slate, marble, and similar materials. The drills will not work as well at high speed as at slow speed because of the excessive friction.—Arthur F. Cox, Chicago, Ill.

Babbitting Drill in Drill-Press Spindle Avoids Heavy Work

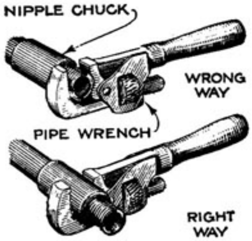
Some castings were to be drilled, and the only means at hand were a hand breast drill and a heavy radial drilling machine. The chuck of the machine was 4 in. too low, in its upper position, to permit the castings to fit under it. The job was accomplished by babbitting a drill in one of the sockets used to reduce the size of the spindle hole for small taper-shank drills. To hold the drill in place while pouring the babbitt around it, the rigging shown in the sketch was used. The drill was set into the center of a wooden block, held in place as indicated. The socket was suitably plugged, and the metal poured in. The chuck was taken out of the spindle, and the socket became practically a chuck, saving enough height on the spindle to make room for the job.



A Tedious Hand-Drilling Job Was Avoided and the Work Turned Out in Short Order by Method Shown

Proper Use of the Nipple Chuck

Many a good mechanic will spoil a perfectly good short nipple, after threading it in the chuck, by trying to unscrew it by means of a pipe wrench gripping the newly cut threads. The nipple, with threads cut on one end, is screwed into the nipple chuck, consisting of a piece of pipe of the same size as the nipple, and about a foot long, with an ordinary pipe sleeve or long coupling screwed on for about two-thirds of its length.

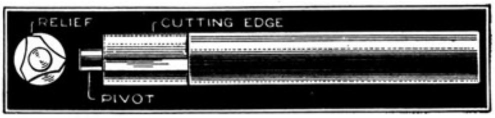


The nipple, having one end threaded, will bottom against the pipe and prevent it from screwing too far into the sleeve when the die is rotated. All this is common practice; it is the removal of the completely threaded nipple without spoiling the thread that constitutes the trick. Instead of catching the threads with the pipe wrench and crushing them, the wrench is applied to the sleeve and turned far enough to separate the abutting ends of the pipe, where the nipple can easily be unscrewed by hand.—Edwin J. Bachman.

¶To make a paint of dry white lead of the proper consistency requires about half its weight of linseed oil; dry zinc white will take nearly its own weight in oil.

Counterbore Ground Quickly from Round Stock

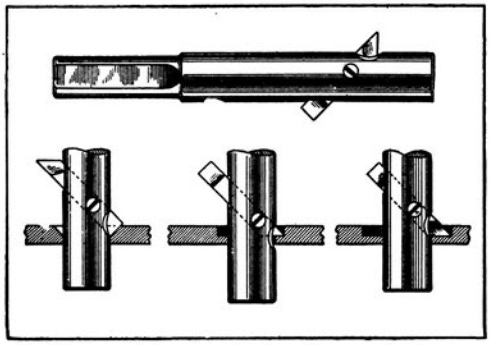
Often the mechanic in the machine shop requires a special size of counterbore and does not find it in his stock of tools. A quick method of supplying such a bore is to take a piece of tool steel and turn it to a shoulder pivot, as shown in the sketch, and then grind it to the proper cutting edges. The grinding can be done readily on an ordinary emery wheel, and care should be taken to provide the necessary relief at the cutting edges. The pivot, of course, must be made of the proper size for the center hole, and the lower cutting edges of the counterbore should also be given a relief toward the back.



A Counterbore Can Be Ground Quickly from a Piece of Tool Steel, Which Is Then Properly Tempered

Adjustable Counterboring Tool Has Many Applications

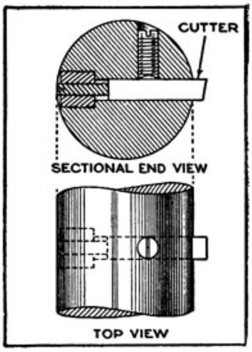
Mechanics whose work calls upon them for a variety of counterboring jobs will instantly recognize a wide range of applications for the adjustable tool illustrated. Any desired size or shape of counterbore may be made with the one tool, depending upon the setting that is given the cutting member, or the angle to which it may be ground. The cutters are of high-speed steel, and if the hole in the bar is to be made exactly 45° the cutting edge is measured with a protractor and ground accordingly. The bar is made of milled steel and should be casehardened.—M. L. Lowrey, Livermore, Calif.



The Sketches Illustrate Various Types of Counterbore Jobs to Which the Tool Is Applicable

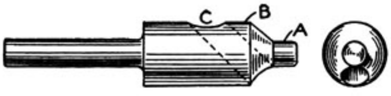
Simple Boring-Bar Adjustment

A convenient method of adjusting the tool in a boring bar is shown in the illustration. Before the bar is slotted for the tool, a hole, larger than the intended slot, is drilled about one-third of the way through from one side of the bar. A smaller hole is then drilled through the bar, in the center of the large one, this smaller hole being squared out to take the tool. The large hole is tapped, and a plug screwed tightly into it, the plug, in turn being drilled and tapped for a setscrew, as shown. The tool is held, when adjusted, by the setscrew bearing on the top. This device is especially useful when boring work clamped to the lathe saddle, where several cuts must be taken, the necessary adjustment being easily effected, and the tool securely locked, when set. This adjustment eliminates much of the usual lost time.



A Countersink

Carpenters and cabinetmakers have considerable trouble to countersink a hole in wood for the head of a screw, as the grain of the wood is liable to run in any direction and throw the countersink off center. The illustration shows a tool that has proved invaluable in making a true and clean countersunk hole.

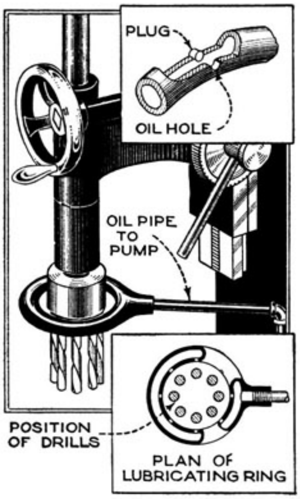


The Shape of the Cutter and the Manner of Relieving the Chips Make the Countersink Cut Straight

The tool can be made of tool steel, if desired, but the one I have is turned from a piece of machine steel and casehardened. The end A is turned to fit the hole in the wood and the part B is the size of the screw head. A hole, C, is drilled diagonally through the metal, the diameter being the distance from the shoulder A to the outside of B on the tapering surface. The tool will cut whichever way it is turned.—C. Cain, College Point, L. I.

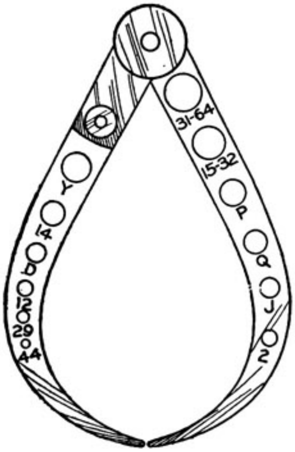
Supplying Lubricant to Drilling Head

To supply lubricating and cooling compound to the eight spindles of a drill head, the arrangement illustrated was successfully used. A hollow casting served as the lubricating ring. The holes through which the lubricant flowed were drilled entirely through the walls of the casting, the superfluous orifices in the outside diameter being closed with plugs. The completed lubricating ring was placed around the drilling head, and connected to the oil pump on the machine with pipe. In use, the lubricant is pumped through the holes and runs down the drills.



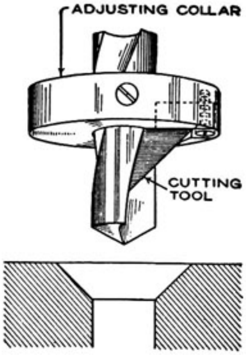
Combination Calipers and Drill Gauge

Considerable time can frequently be saved by using an instrument provided with a combination of gauges, or one which can be used for several purposes. An ordinary pair of calipers can be so arranged. It may be drilled, reamed, and marked for various sizes of drills, or rods, most frequently made use of. It is then merely necessary to slip the proper-size gauge hole over the round stock, and its size can be read off directly, thereby avoiding the necessity of first carefully adjusting the calipers and then finding the size on a rule. The calipers would in no way be spoiled for their regular service.



Adjustable Countersink on Drill

The tool illustrated drills a countersink in one operation. It is adjustable so that any depth of hole can be drilled. The attachment fitted to an ordinary twist drill consists of a collar containing a setscrew and a plate made of hardened and ground tool steel. The plate, or cutting tool, fits into a flute of the drill, and is attached to the collar with a screw. Separate tools are required for each size drill.—W. R. Calver, Brooklyn, N. Y.

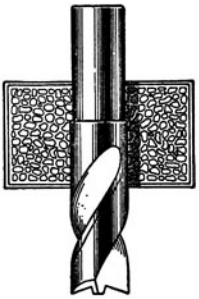


Tightening a Loose Bushing

Sometimes, after pressing bushings into their places, they are loose and turn when an attempt is made to ream them out. In this case, remove the bushing, and run a coat of solder around the outside of it. Force the bushing back into place and the excess solder will be scraped off and a tight fit will result, with no turning of the bushing in reaming it.—J. W. Reynolds, Mason, Illinois.

Drill for Fiber and Soft Metals

The drill illustrated is the result of a great deal of experimenting with such material as fiber and hard rubber. If these substances are drilled with a tool sharpened in the ordinary way, a very rough edge and often an irregular hole will result. A drill ground as shown will cut a clean, smooth hole to a quite accurate size, and will do the work faster than the ordinary drill. Such materials as copper, lead, and bronze can also be handled with a drill thus ground, and there will be no grabbing or twisting.



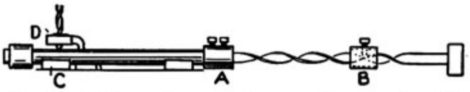
¶To dry boots in a short time, insert a lighted electric lamp, and the heat from it will rapidly evaporate the moisture.

Ideas on Drill Presses

Drill Press Used to Cut Spiral in a Shaft

Having a long spiral to cut in a shaft that was too long for the lathe or milling machine, I did the job very successfully in a drill press. After it was finished, mechanics who had varied experiences would not believe that such a good job could be done on a drill press.

As the lead had to be four turns per foot, a piece of ¼ by 1-in. bar iron of suitable length was cut and placed within a 1-in. pipe, 12 in. long. One end of the flat iron was gripped in a vise, while the other end was turned with a strong wrench to make four complete turns. The spiral thus formed served as a lead screw for the work. The spiral and stock were fastened together with a coupling, at A, and a guide block, B, was clamped to the table, while the work was resting on V-blocks, C. The drill was guided with a jig, D, which was fastened to the platen of the machine.—Albin P. Swaidmark, Orlando, Fla.



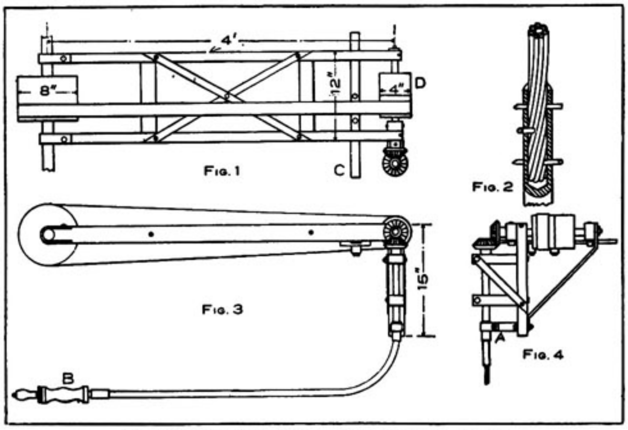
The Spiral Thrust Gave the Proper Turns to the Shaft under the Drill Point

¶A reamer should not be turned backward in a hole.

Homemade Flexible Shaft Boring Machine

The frame of this machine is made of 2 by 1¼-in. well-seasoned beech and is fastened together with 3-in. screws. The side pieces are about 4 ft. long and braced in the center of the frame with two pieces of 1-in. band iron. One end of the frame is mounted on the main shaft, while the other is held parallel with the ceiling by means of hooks. The shafting is ¾ in. and runs in babbitt metal bearings. The gears were taken from an old reaper. A piece of ½-in. steel cable containing seven strands of nineteen wires each was used for the flexible shaft. The method of fastening the ends is shown in Fig. 2. A ½-in. hole was drilled 3 in. deep into the end of the gear shaft and one end of the cable put into it and held with three pins. When using wire nails for pins they can be driven through the cable without drilling, which will expand the end of the cable and make it fit the hole tightly. Holes must be drilled through the shaft to take the pins. The pins are then cut off outside the shaft and smoothed down level.

The cable was covered with a piece of ½-in. rubber hose and fastened with a clip, A, Fig. 4, to keep it from turning. The handle, B, Fig. 3, is made of wood, and each end is fitted with bearings taken from the crank hanger of an old bicycle. A piece of ¾-in. shafting runs through the handle, B, and the other end of the cable is fastened into this in the same manner, as shown in Fig. 2. A chuck taken from an old brace was fastened to the other end of the shaft in the handle. The slide, C, as shown in Fig. 1, is used to shift the belt to the loose pulley, D, when the machine is not in use. The device may be used on either side of the main shaft by unhooking and swinging the frame under the shaft.

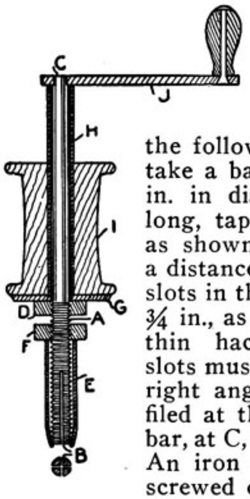


May Be Used on Either Side of Main Shaft

¶Kerosene oil should be used as a lubricant when reaming aluminum.

¶When broaching cast iron, use soda and water as a lubricant.

A Small-Needle Drill



A hand drill for very small work in metal can rarely be obtained at the hardware or tool-dealer's store, and, if it can, it is usually very expensive. A very efficient drill, that is easily made and costs but little, can be constructed in the following manner: First take a bar of round steel, ¼ in. in diameter and 4½ in. long, taper one end slightly as shown, and thread it for a distance of 1¾ in. Cut two slots in this end to a depth of ¾ in., as shown at B, with a thin hacksaw blade. The slots must cross each other at right angles. A shoulder is filed at the other end of the bar, at C, to receive the crank. An iron or brass nut, D, is screwed on the threaded end and soldered in place. Procure a brass or iron tube, E, 1 in. long and fitting loosely on the shaft A. One end of this tube is swaged with a light hammer until it is too small to pass over the shaft, and the other end is firmly soldered to a brass or iron nut, F, so that when this nut is screwed upward on the threaded part of the shaft, the swaged end of the tube will force the jaws B tightly together, thus forming the chuck that will hold different-sized drills firmly.

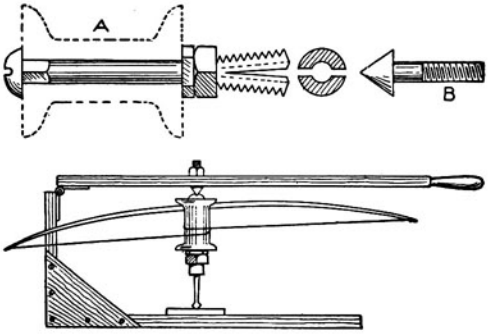
Slip a washer, G, over the other end of the shaft. Procure a piece of brass tubing, H, about 2⅝ in. long, which will fit the shaft loosely enough to allow the latter to turn freely. Slip this on the shaft down to the washer G. This should bring the top of the tube even with the shoulder C. An ordinary darning-cotton spool, I, is now forced tightly on this tube to form the pressure handle.

The crank, J, is made of a piece of iron or brass, ⅛ in. by 5⁄16 in., and 2 in. long. A small wood handle is riveted to one end and a hole is cut in the other end to fit over the end of the shaft C. This can be made secure by soldering, taking care to keep the flowing metal away from the tube H, so it will be free.

The drill points are easily made of different-sized needles. Break off the eye, and the point where it starts to taper. Heat and flatten one end until it spreads out on either side, but do not make it too thin. This end is then pointed and sharpened the same as any ordinary flat drill. The shank may be left round, but will be held more firmly in the chuck, if it is made square. The drills should be tempered before using and care should be taken to slightly draw the temper from the shank to keep them from snapping off at this point. When drilling, do not exert too much pressure, as this has a tendency to make the drill bend toward one side or the other.—F. L. Matter, Portland, Ore.

Hand Drill for Fine Work

A very handy little tool for drilling small holes is the so-called fiddle drill. The tool is very easily made, and costs nothing but a small amount of time to put it together.



Fiddle Drill

All the material required is a spool, a ⅜-in. bolt long enough to go through the spool and allow about 1 in. to extend at the end, one small hinge, one short ¼ or 3⁄16-in. bolt, and one narrow piece of leather or belt lacing. A piece of stout cord will answer for the latter.

Use a springy piece of wood about 25 in. long for the bow. The cord is tied on the ends of the bow, leaving it so that when the cord is wound once around the spool there will be sufficient tension to turn the spool. The ⅜-in. bolt has a hole drilled about 3⁄16-in. deep in the end. The bolt is then taken to the vise and a slot sawed down with a hacksaw, about ¾ in. deep. This part of the bolt serves as a chuck to hold the drill.

The shank of the drill should be made a little larger than the hole in the bolt, so that when it is put in, the end of the bolt will spring apart, and when the nut is screwed down tight, it will squeeze in on the drill and hold it securely. There should be two nuts on this bolt, one to jam up and hold the spool tight and the other to clamp the drill as shown at A. A deep hole is then made with a center punch in the center of the bolt head.

as also handwheel shaft E. Cut a 3/16-in. keyway in the shaft F. Obtain a pair of bevel gear wheels. Fix the small wheel on the shaft tightly with a pin, but allow wheel on the vertical shaft to slide with a flat key. The feed is controlled by the wing nut L. Two coil springs, KK, keep the pressure plate against the thumbnut.

The dimensions H H, Fig. 2, must be determined by the size of the wheels procured. The top of the shaft F must be turned to form a notch to slip into a slot cut in the plate G, which is 1¼ by ⅜ in. All bolts and studs are ⅜ in.—J. W. Verner, Roxbury, Mass.

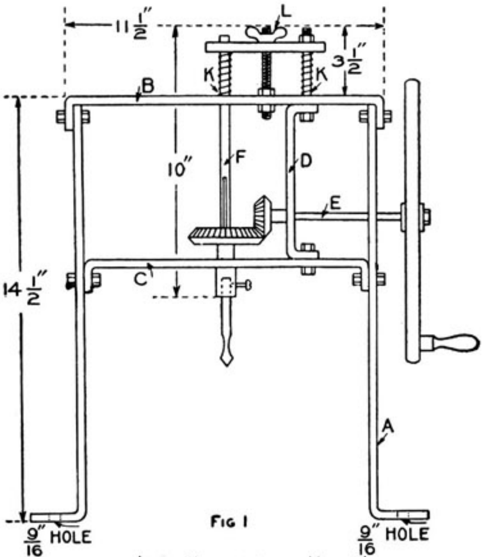


FIG I

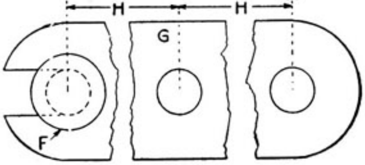


FIG. 2

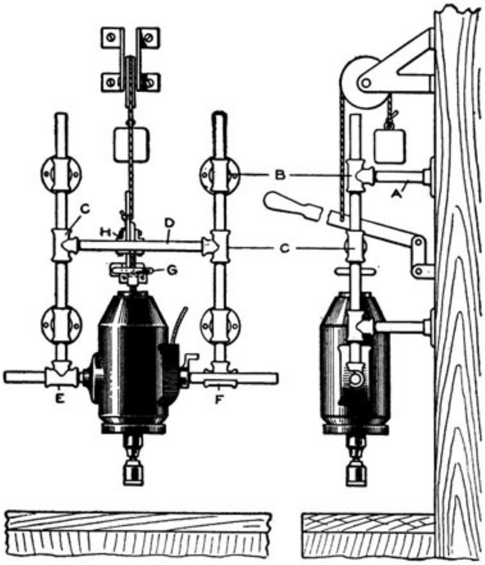
Details of the Drill Press

Portable Electric Drill Used as Drill Press

Many shops are provided with a portable electric drill, which is a necessity for certain kinds of work, but not used often. The frame shown in the illustration was made to fit a drill of this type, and extended its usefulness to the many kinds of work ordinarily done on a small drill press. Most of the parts of the support and mechanism were made from pipe and fittings. The machine is fixed to a frame of wood, which supports a table on which the work is rested. The wooden support may be arranged so that it can be moved without taking the drill and fittings from it. The drill is supported in a frame which is raised and lowered by means of a lever, fixed to a counterweight.

Four standards, A, made of a section of 1-in. pipe, a flange, and a tee are fixed to the wooden frame. The frame of pipes and fittings which carries the drill is made of pipe of an outside diameter to slide closely in the tees, B, of the standards. Tees, C, are fixed solidly to the center brace D, and the sections of pipe joined to them. The shaft of the drill is rested in a tee, E, and in the tee F, which is cut open so that the shaft may be removed readily. The drill is held securely between the brace D and its bearings by means of the handwheel G, operating on a threaded rod set into a lug on the lower side of the brace.

The handle and its fittings are made of strap iron. The range of the drill is limited by the movement of the handle, which is fitted to the brace D by means of a shoe, H, in which it slides. The counterweight cord is fixed to the handle and passes over a pulley set in a bracket above the pipe frame.—W. A. Ready, Boston, Mass.

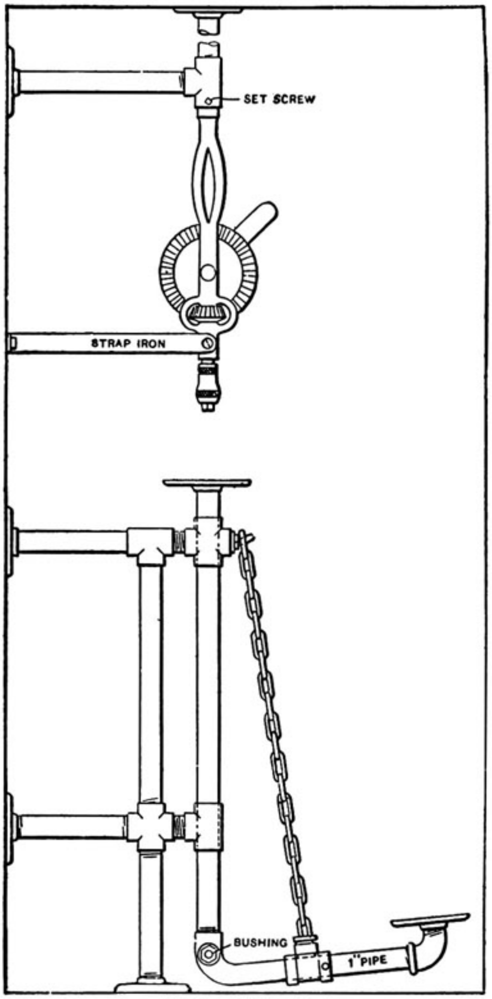


This Frame of Pipe and Fittings Enlarged the Range of Usefulness of a Portable Electric Drill

Foot-Power Feed for a Breast Drill

The accompanying illustration shows how a common breast drill was rigged up so it could be fed by foot power; the crank turned with one hand and the work to be drilled was held with the other. The bottom frame is made from ¾-in. pipe and fittings, except the treadle, which is 1-in. pipe. The pipes holding the drill may be ½ in. and the strap iron fastened with screws as shown. The whole is fastened to the ceiling, side wall, and floor.

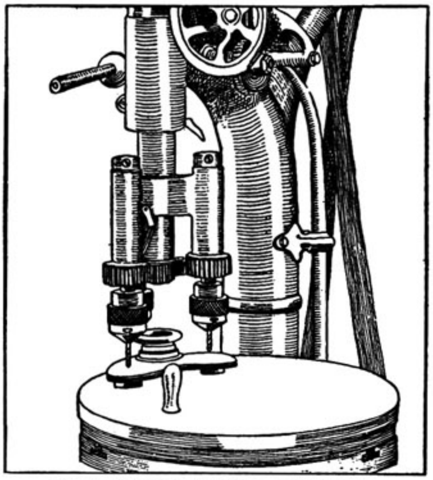
The tee and cross connections in the lower part of the frame are bored out so the ¾-in. pipe will slide through them. The plug turned into the cross has a ¼-in. pin fastened into it on which to hook the chain. A flange is screwed on the upper end of the ¾-in. pipe for a faceplate. The bottom end of the ¾-in. pipe is fitted with a ½ by ¾-in. tee which has a bushing turned into each end for a ⅜-in. rod. The 1-in. pipe forming the treadle must have one end flattened down to about ½ in. thick, then given a short right angle bend, and drilled for a ⅜-in. rod. The tee on the bottom end of the ¾-in. pipe is cut out in the center to receive the turned end of the 1-in. treadle pipe. The tee at the bottom end of the chain has the thread bored out so that it will slide along the 1-in. pipe and be placed in any desired position and held with setscrews. Any desired depth of hole or different-sized pieces can be drilled by raising or lowering the chain on the pin.



Parts Made of Pipe Fittings

Homemade Multiple-Drilling Attachment

In small manufacturing plants, and even in jobbing shops, it sometimes happens that a lot of drilling is laboriously accomplished by drilling one hole at a time, that could be done at an enormous saving if put on a multiple-spindle drilling machine, but the number of pieces required is not sufficient to justify the purchase of such a drilling machine.



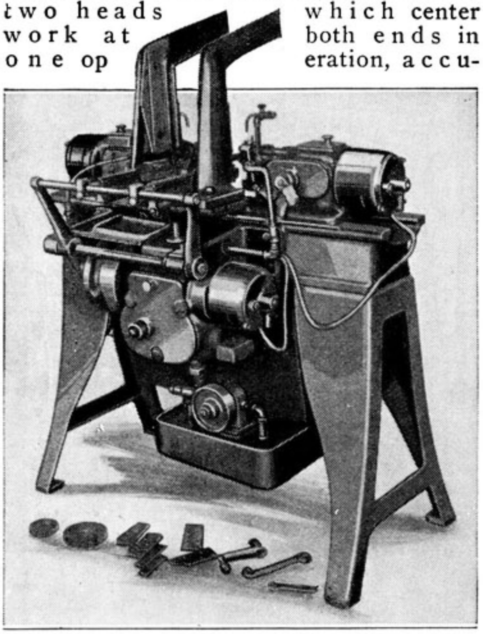
Cheap Multiple-Drilling Attachment

It is for such an emergency that the multiple-spindle attachment for plain drilling machines, herewith illustrated, is recommended, it being shown in operation. The device is very simple, and can be made in any machine shop. It is merely a light frame attached to the drill, in which runs three spindles geared at the lower ends to the central spur on the main spindle.

In the illustration these gears are shown without any guard, but in actual use the gears are covered with an aluminum guard to prevent the accidental catching of fingers or clothing in them. On the lower ends of these small spindles are chucks for holding the drills. Spindles to drive drills of larger size may be geared to the driving pinion with a larger size gear to reduce the speed of the spindle driving the larger drill.

Machine Centers and Drills Automatically

Designed for use in quantity production, an automatic centering machine has two heads which center work at both ends in one operation, accurately and rapidly. The machine has also an automatic drill-feed mechanism operated in conjunction with a magazine. Clamping of the work is done mechanically, so that after it is set up, it is only necessary to replenish the magazine, and take away the finished parts. The work is removed from the magazine by transfer slides, is placed in the vise, clamped, centered, and then released into the work box, without any attention from the operator. The feed to the drills is automatic, by means of the same cam that operates the transfer slides. This cam is driven by a small motor, and a set of change gears adjusts the drilling time.



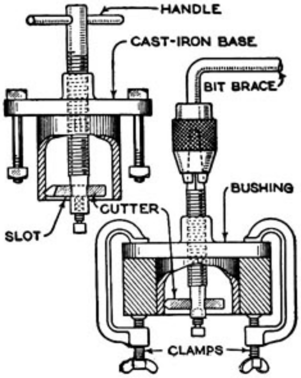
This Machine, Designed for Production Shops, Automatically Centers and Drills Work

Breast Drill Hung on Coat Hooks

The amateur mechanic generally hangs his tools on the wall by screweyes, nails, etc., but when he tries this method with a breast drill, he finds that none of these will hold it. If two coat hooks are set in the wall, about 2 in. apart, the drill will hang straight and secure on them.

Simple Hand-Boring Fixture

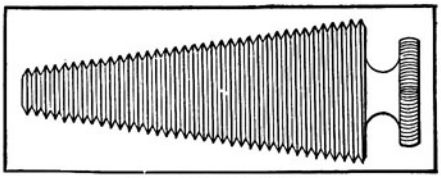
Many boring jobs may be expedited by improvising methods of doing the work without dismantling the machine being overhauled or machined. A simple fixture that can be applied to many jobs is shown herewith. It consists of a cast-iron base, having a tapped boss through which works the threaded boring bar. The threads should be about 20 per inch, and suitable holes for clamping the fixture to the work should be drilled in the base.



When boring bronze, or similar metals, a square-end boring bar may be used, the end being held in the brace chuck, thus speeding up the work. The bar feeds itself through the work, and the threads must be kept well lubricated.

Calipering Taper Tapped Holes

The tool shown in the sketch is used for calipering taper tapped holes in boilers when fitting studs. It is a simple, though very useful and economical tool, and it will doubtless be appreciated by those having much work of this kind to do. The thread part of the tool is about 3 in. long, with the small end ¼ in. and the large end 1 in. in diameter. The hole in which the stud is to be fitted is calipered by filling the threads of the plug with chalk. When the plug is removed the chalk will show exactly the largest diameter of the hole.



Taper Thread Caliper

¶Saturate a small piece of cotton batting in glue and wrap it around a nail, then place it in a hole previously made in a plaster wall. When the glue dries, the nail will remain permanently.

A Boring Machine for Crankshaft Bearings

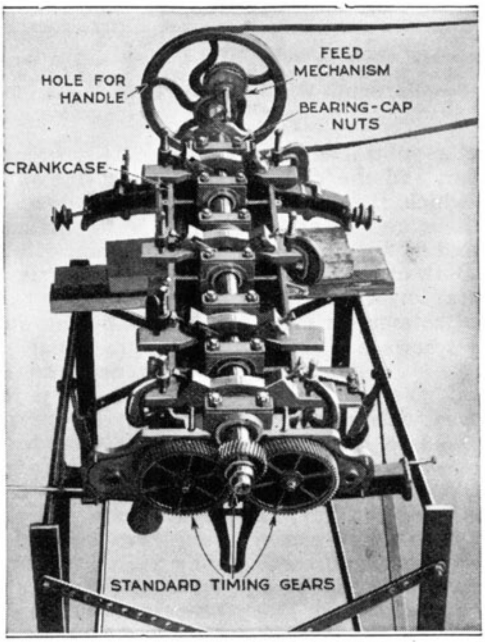
By EDGAR GARDNER

MODERN high-class automobile engines are for the most part designed to use the pressure oil-feed system Oil is conducted to each point which requires lubrication by means of pipe leads and oil passages, under pressure from a pump. The splash system is thus eliminated, and the amount of oil supplied to meet the requirements of varying engine speeds is automatically controlled, resulting in increased efficiency and economy.

The main crankshaft and connecting-rod bearings in engines of this type must be fitted practically oil-tight. Any oil that can leak through the bearings will follow the crankshaft to the crank throw, and will be thrown up into the cylinders. The necessity of having oil-tight bearings presents a condition very difficult to meet with bearings designed to use shims. To prevent leaks, it is necessary that the two parts of the bearing be fitted solidly, metal to metal, and the caps bolted down solid, making an oil-tight joint where the halves of the bearing meet. Besides preventing oil leaks, this construction makes a more solid and rigid unit than is possible where shims are used, and, in connection with the oil-pressure system, helps produce a very durable engine. The oil being under pressure, the crankshaft is practically floated in the bearings.

The approved practice in high-class engines is to make the bearing of bronze, bored large enough to allow facing with babbitt metal to form the bearing surface. The main and connecting-rod bearings must be fitted with an equal clearance around the entire circumference. The old practice of relieving them at the sides, so successfully followed with the splash system, cannot be followed with the pressure feed, as it would allow the oil to leak out of the sides of the bearing, causing an excess supply of oil at points that have been specially provided with oil leads to furnish the required amount. On bearings designed for the pressure system, the oil pocket is formed with a special tool, making a series of narrow grooves, with a strip of metal between each groove. These strips retain the bearing fit, forming a serrated oil pocket.

The factory, with special tools and jigs, meets the requirements of the system without difficulty. To the repair shop, however, the rebuilding and overhauling of this type of engine presents quite a problem, as more different sizes are encountered. The hand-scraping method of fitting bearings is a tedious job, and is seldom successful where the pressure system is used, since the scraper marks, extending through the end of the bearing, are apt to form a passage for oil to leak through.



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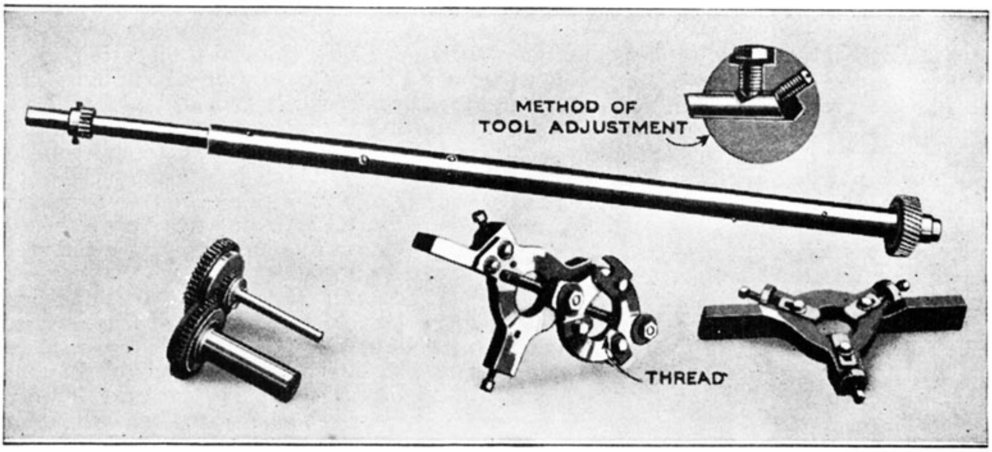
Assembly View of the Boring Apparatus: The Bar, Working in Steady Rests, and Fed by a Lead Screw, Bores Out Each Bearing with a Tool Adjusted to Give It a Proper Finish Diameter

The boring bar illustrated was built for repair-shop service, and is in constant use on a leading make of six-cylinder engine, having a seven-bearing crankshaft. It is found to produce work which meets the exacting requirements of the pressure system, retaining the original high efficiency of the engine. It works on the old boring-bar principle, so familiar to mechanics, and can be operated either by hand or by power.

One cutting tool is provided for each bearing. The method of adjusting the tools to bore out the bearing to exactly the proper size is illustrated in the insert of the second photograph. The tools are fitted into round holes made in the bar; these should be blind, so that an exact measurement can be made with a micrometer from the cutting edge of the tool to the opposite side of the bar. From

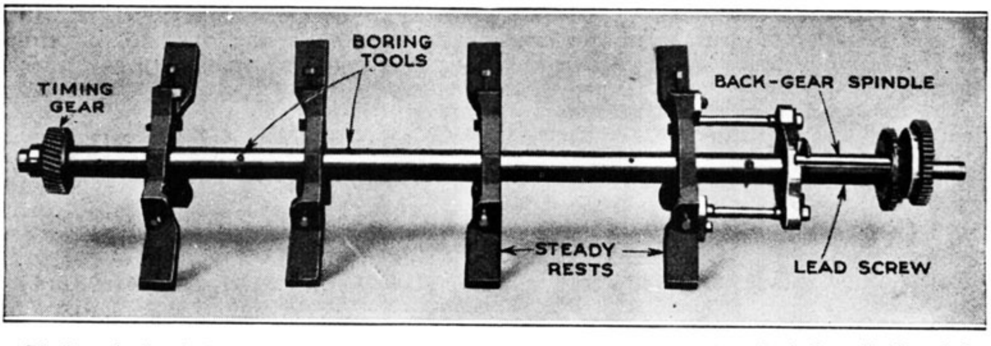


Exploded View of the Apparatus: Above Is the Boring Bar Itself, and in the Insert a View of the Tool Adjustment. To the Left, Below, Is the Train of "Back Gears" through Which the Lead Screw Is Driven. In the Center Is Seen the Built-Up Nut in Which the Lead Screw Works. To the Right Is One of the Steady Rests

this measured distance is subtracted the known radius of the bar, and the difference is the radius to which the bearing will be bored. If this is too large or small, the tool is adjusted by turning one of the two setscrews. Both of these work against beveled surfaces formed on the tool, and the desired adjustment is made by loosening one of the screws, and tightening the other.

The bar is fed through the cut with a mechanical feed of special design, which enables a fine-pointed tool to leave that highly burnished finish, so much desired in high-class work. A lead screw is cut on a sleeve, which fits over the bar, as seen in the third photograph. This sleeve makes a sliding feed on the bar, and turns in the same direction, at a reduced speed imparted to it by a train of gears. The internal thread in which the lead screw works is cut on the ends of three steel fingers, which project from a frame, shown in the center of the second photograph. This frame is fastened rigidly to the nearest one of the several steady rests, mentioned below. The pitch of the lead screw is 16 threads to the inch, and the train of gears gives a reduction of 9 to 1, so that the bar is fed 1 in. for every 144 revolutions.

Before boring out the bearings, the engine crankshaft must be carefully straightened and calipered with the micrometer; if it is found to be out of true, it must be reground, and the final diameters recorded for use in machining the bearings. To prepare the bearings for the reboring process, the bronze shell is rebabbitted, and the two parts are carefully matched and chucked in the lathe; they are rough-bored to a size that will leave sufficient metal for the finish-boring process. The oil pockets and grooves are cut, and the bearings fitted into the crankcase. Since the crankcase, being made of aluminum, is very easily sprung out of shape, it is advisable to turn up the



The Bar, the Steady Rests, and the Feed Mechanism in Position: The Spindle of the Back Gears Is Extended, and Is Held from Turning by a Dog, Attached to the Built-Up Nut. Four Steady Rests Are Used in Working on the Six-Cylinder Engine

bearing-cap nuts to the proper tightness, and to mark them so that they can be brought back to the same point in the final assembly. It has been found that drawing up the bearing-cap nut the small distance of one cotter-pin notch, after the bearing has been finished, may spring the case and throw the bearing out of true.

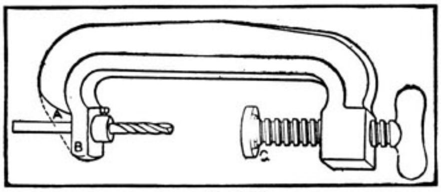
As seen in the first photograph, the boring bar is supported on brackets having adjustable steady rests, as in ordinary lathe practice. The front end of the bar is fitted with a standard timing gear, similar to the one on the end of the crankshaft. The boring bar is located, by means of the steady-rest adjustment, so that this gear meshes, with just the right amount of play, with the two large timing gears on the crankcase. The rear end of the bar is located by means of a slip ring, or sleeve, bored out to a sliding fit on the bar. The outside diameter of the sleeve is to fit the bearing, as rough-bored in the lathe; in practice, this end bearing will be roughed out to fit the sleeve which is to be used. The bearing is centered for rough-boring by reference to the bronze shell; this is located by the factory with sufficient accuracy to enable it to be used to find the correct center. Before starting the finish-boring, however, measurements should be taken with a depth gauge from the boring bar to the faces of the crankcase to which the cylinders are bolted. If the boring bar is found to be parallel with these faces, then it is correctly placed. The tools have already been set to produce the correct diameter, and the bar is now fed through, giving the finished bearing surface to the babbitt. After this boring operation has been completed, the only hand work necessary in fitting the crankshaft into place is that of relieving the ends of the bearings to fit the fillets of the crankshaft.

After the crankshaft has been finally assembled, the connecting-rod bearings, which have been accurately bored out in the lathe, are fitted to the shaft. An oil-pressure test, running up to a pressure of 50 lb. per square inch, is then applied. This figure is selected as compared with 35 lb., which represents the usual maximum working pressure. If no leak appears at the test pressure, the engine is ready for final assembly.

Besides the great advantage of eliminating the tedious process of hand scraping, the boring process has the advantage of alining all of the bearings very accurately with each other, resulting in a remarkably free-running engine. The boring method is found in practice to give a surface not inferior to that produced by reaming, and the equipment required is within the reach of any shop which does any considerable quantity of engine overhauling.

Homemade Portable Drill

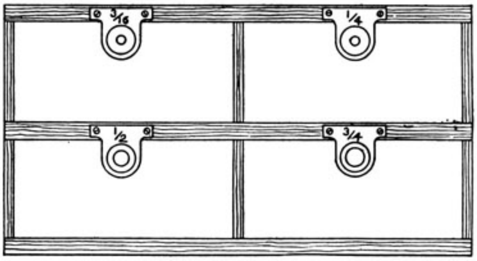
A quick and simple method of making a portable drill is by taking a large clamp, cutting out a part of the web, as shown at A in the sketch, and then drilling a ½-in. hole through the upper jaw, B, through which hole the drill may be placed. A collar with a setscrew is made and placed on the drill shank, the collar bearing against the inside of the upper jaw. The drill may be turned with a chuck on a bit stock, or a crank may be provided with a setscrew for clamping the drill, which will serve the purpose equally well. The feeding is done by the clamp screw, C. This style of drill may be used in numerous places where no other device could be applied. The clamp can be used for the drill or as a clamp.



Portable Drill

Storage-Bin Marker Plate for Twist Drills

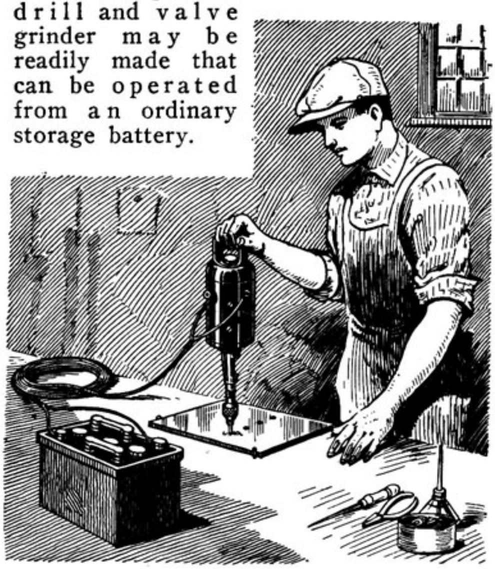
The usual tool-room storage bin is equipped with compartments marked with a plate which carries a hardened steel bushing of the proper diameter in addition to having the size stamped upon it. Before the keeper hands out a drill it is tried in the bushing, thus eliminating any mistakes in sizes. The drill is also tried in the bushing when it is returned to the bin.



The Marker Plate and Sized Holes Designate the Size of the Drills in Each Compartment

Electric Drill Made from Old Starting Motor

Almost every garage and repair shop has at least one old starting motor lying around the place, from which an electric drill and valve grinder may be readily made that can be operated from an ordinary storage battery.

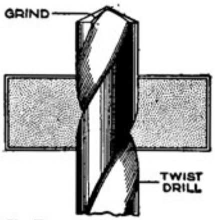


An Electric Drill Made from the Electric Starting Motor of an Old Automobile

The motor shaft is cut off about 4 in. from the end of the motor, and the shank of a breast drill is dressed down to the same size, the drill chuck being held to the shaft with a tight-fitting sleeve of metal tubing, which is welded in place after both have been lined up. As there are many types of starting motors, the description given for the construction of a drill of this type can only be suggestive. —Denby Clark Stephenson, Augusta, Kansas.

Alteration Adapts Twist Drill for Soft Metals

To modify a twist drill so that it can be used satisfactorily for drilling brass or bronze, it is merely necessary to grind off on an emery wheel the lips, or cutting edges, as shown in the sketch. This operation tends to prevent the drill from digging or tearing the hole and thereby spoiling the material. — Clifford C. Raymond.



Making a Reamer Cut Oversize

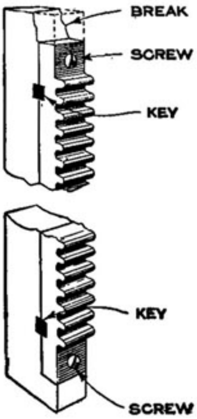
When a smooth, round hole of small diameter is required, a hand reamer is used to produce it, and many times the reamer is from .001 to .004 under size. The reamer may be made to work effectively in the following manner: With a scraper made of a medium-size, half-round file, burnish the face of each flute with the oval side. This will raise an edge and cause the reamer to cut larger, the size depending on how long and hard the faces are burnished. This, of course, does not make a permanent edge, but it does very nicely in an emergency.

Stacking Work on the Broach

It is a common practice, when broaching a number of short pieces, to stack them on the broach to the necessary length. This is a dangerous practice, unless the length of the work is greater than the pitch of the teeth, as, if the length is less than this, a piece may drop down between the teeth and cause tooth breakage. Another important thing to observe when broaching work, is that the faces of each piece are finished true with the bore.

Repairing Drill-Press Feed Rack

While using a high-power radial drill press the heavy downward pressure was so great that the shoulder on the rack was broken, as indicated in the drawing, and the screws sheared off. Obviously, it was impractical to make a repair that would throw the entire strain on the feed-rack screws. After the sheared off screws had been drilled out and the holes tapped, keyways were cut in both rack and sleeve and the rack fastened with new screws, while keys, made from ⅝-in. key steel, were driven into the keyways, as shown in the drawing, to take the end pressure. —A. A. Stafford, San Francisco, Calif.

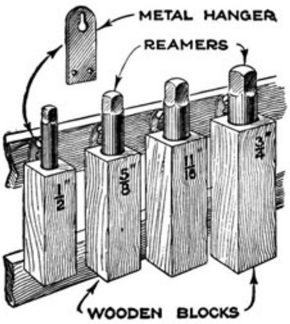


¶A hand reamer should never be used for power reaming.

Special Methods for Reaming and Broaching

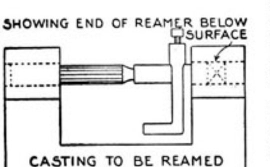
A Reamer Protector

Reamers that are allowed to lie around the bench or in the tool box together with other tools soon have their cutting teeth nicked and dulled, so that they become practically worthless for fine work, or at least would require regrinding to make them serviceable. The drawing shows a simple and inexpensive method of protecting each reamer in an individual case, which consists simply of a square block of wood, bored out large enough to accommodate the reamer, and marked with the size of the tool on the outside. A small metal hanger of the type shown is fastened to the top of each case so that it can be hung over a screw in the wall, or on a special rack.—E. N. Davey, Montreal, Canada.



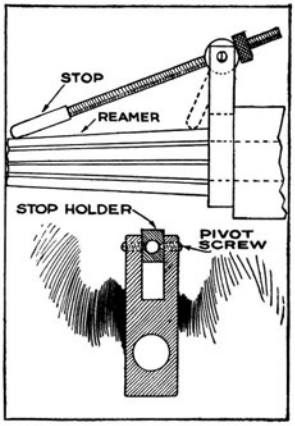
Reaming Holes in Odd-Shaped Castings

I have had occasion to ream castings like the one shown in the drawing—castings that had to have a hole reamed through the two hubs—and didn't have a reamer long enough to go clear through. A way to do this, if you have a reamer long enough to be in both hubs at one time so as to keep the holes in line, can be seen by a glance at the figure. After the reamer has been put down as far as a wrench will turn it, it is backed out enough to allow a lathe dog to be slipped over it and between the hubs. By means of this dōg, the reamer may be turned, either with the hands or the assistance of a short bar, and passed down through the lower hub. Two holes reamed thus continuously are more apt to be exactly in line than if reamed separately from the outer ends.—D. A. Hampson, Middletown, N. Y.



Stop for Taper Reamers

When using taper reamers with a stop attached to the reamer itself, a solid stop consisting of a metal ring reamed out to the size required is generally used. This makes a good stop, but it has the distinct disadvantage of being useful for but one particular size or depth of cut, and if a cut even 1/16-in. deeper is to be taken, it is necessary to use another stop, or ream out the first one. Various depths are required on one reamer, and the adjustable stop illustrated was designed to meet such requirements. The main part of the attachment is made from a block of tool steel, drilled at one end to fit over the shank of the reamer, the opposite end being slotted to take the stop holder, which is a small steel disk, with small centers on its sides, and a hole drilled and tapped through its center for the threaded stop. The stop holder is held in place by two screws, the pointed ends of which fit into the centers. The stop proper is made from a piece of 5/16-in. drill rod, rounded at one end, threaded to fit the tapped hole in the stop-holder block, and fitted with a knurled locknut.

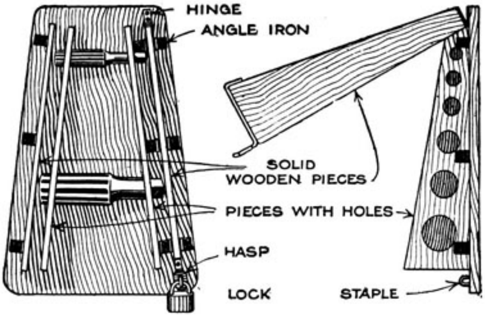


When in use, the device is slipped over the reamer shank, which is then inserted in its holder, or wrench, the attachment being held tightly between the reamer and face of the holder. To set the reamer for any desired depth of cut, the stop is screwed in or out, and the adjustment held by screwing down the knurled nut. The single round end of the stop makes an ideal stop, as the cuttings do not collect around it as in a solid stop, and when correctly set, the rounded end will lie snugly in one of the reamer flutes.

¶Do not use a reamer in a pipe, as the flux, used in welding or brazing, is as hard as glass and will ruin the reamer.

Rack for Reamers Prevents Misuse

Where valuable reamers are kept without proper storage facilities, their efficiency quickly deteriorates, and if they are taken without the knowledge of the storekeeper, much time is lost in hunting for them. A rack, such as the one shown in the drawing, in which the reamers can be locked, will save much of this annoyance. As shown, it consists simply of a piece of board of suitable size, upon which are attached the two pieces that hold the reamers. One solid piece of wood of the same size as that used for the racks, is attached rigidly in such a position that the reamers abut against it when put into place. A similar piece on the opposite side is hinged to the upper part of the base, so that it may be lifted for withdrawing the reamers, or locked in place. —John G. Pope, Worcester, Mass.



Unauthorized Use of Reamers Is Prevented by This Rack in Which the Tools May Be Locked

Burrs inside Tubing and Castings Removed by File in Chuck

Tubing and metal castings having an inside surface frequently require burring. The burrs on the inside surface, caused by drilling holes from the outside or from milling operations, are often difficult to remove by hand. In the burring department of a large factory it is the practice to insert a rat-tail file in the chuck of a lathe. This permits the revolving of the file at high speed, and if the product to be burred is held so that the file operates against the inside surface, the burr is quickly and neatly removed.

An Expansion Reamer

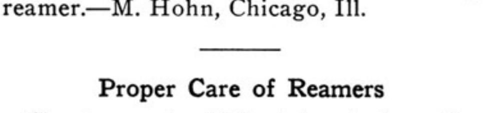
Almost all solid reamers can be used as expansion reamers though a large proportion of mechanics fail to use them as such, even if they know it can be done. The flutes on reamers are cut in various depths and these provide the means of expansion. This method is used to an advantage in a place, for instance, where a pulley is bored too small for the shaft and the only tool at hand that will go in the hole is a reamer. Select a wire that will fit snug in the deepest flute of the reamer when the reamer is in the hole. Take out the wire and insert it in the first or second flute from the deepest and proceed to ream out the hole. If this will not make the hole large enough, put the wire in a flute not quite so deep, and so on, until the right size is obtained.

One of the old-style reamers with the flutes all the same depth will do the same work, if different sizes of wire are provided; the principle in both cases is the same; the wire in one flute will force the cutting edge of the opposite flute into the side of the hole being bored.—Donald A. Hampson, Middletown, N. Y.

How to Make a Taper Reamer

Turn a piece of brass or cold-rolled steel to the same size and taper as the hole to be reamed, leaving it long enough to be held in the chuck. Saw a slot lengthwise of the tool on each side of the tapered part and remove the metal on the cutting side to make a flute for clearance.

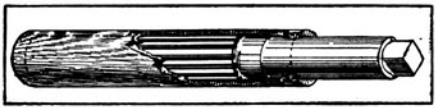
Procure two pieces of a broken hacksaw blade—power saws are the best—and solder each securely in the slots cut in the tapered part. Grind the outer edge of the saw blades to form a cutting edge and to make the same taper as the tapered part. This will make a very good and cheap reamer.—M. Hohn, Chicago, Ill.



Cutter Made of Hacksaw Blade

Proper Care of Reamers

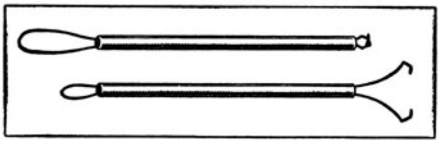
Great care should be taken to keep the flutes in reamers from sand or dirt that may collect in the place where they are stored. Sometimes reamers are kept in drawers where they can roll about striking together, causing the edges to become nicked or worn by the dirt. A simple method of keeping reamers in good condition is shown in the illustration. A piece of hardwood is bored to the size of the reamer and then turned up on the outside, leaving about ⅛ in. of material as a shell. This forms a round covering into which the reamer can be inserted before storing away. Reamers kept in receptacles of this kind will cause no trouble in boring to the proper size.—H. D. Chapman, Washington, D. C.



Receptacle for Reamers

Removing a Reamer from a Barrel

While reaming out a hole in a barrel the reamer slipped through on the inside. Several methods were applied to extract the reamer from the barrel, with failure. At last the simple device shown in the illustration was used with success. The device consisted of a ¾-in. gaspipe of the proper length and a piece of steel wire. The wire was bent in the middle and inserted through the gaspipe. The ends of the wire were bent in the shape shown, and by moving the wire up and down through the pipe the jaws of the wire will open and close.—Harry L. Miles, Winnipeg, Man.



For Removing Tools from a Barrel

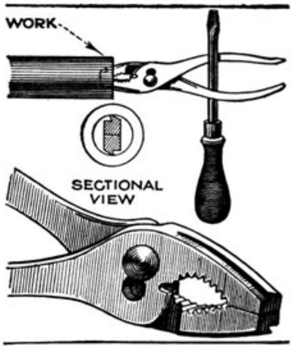
Slotted Nail as Polishing Reamer

A very handy polishing reamer for use on small work can be made by sawing a slot in a nail a little smaller than the hole to be polished, setting a small piece of fine emery cloth in the slot and bending it around the nail. Such a reamer is useful in places such as the bearing of the rocker arm in a magneto timer; with it the bearing can be easily polished.—J. Magis-Frankart, Ouffet, Belgium.

¶Materials to be broached, with a scleroscope reading of much harder than 30, will cause excessive wear on the broach; this can be avoided by annealing so as to bring the reading down to between 25 and 30.

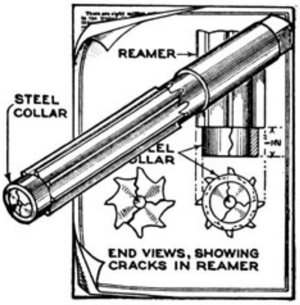
Pliers Used as Reamer

Cutting edges formed on the nose of a pair of pliers are particularly useful to electricians and to pipe fitters, for the purpose of trimming off the burr from the inside edges of conduit and pipe. This is done, in conduit to avoid abrading the insulation of the conductors while pulling them through, and, in the case of pipe, to prevent material from catching on the burrs, and choking the pipe. The nose of the pliers is ground as shown in the illustration. For light burrs, the pliers can be turned by hand; for heavier cutting, more leverage can be obtained by using a screwdriver, placed between the plier handles as indicated.



Salvaging a Cracked Reamer

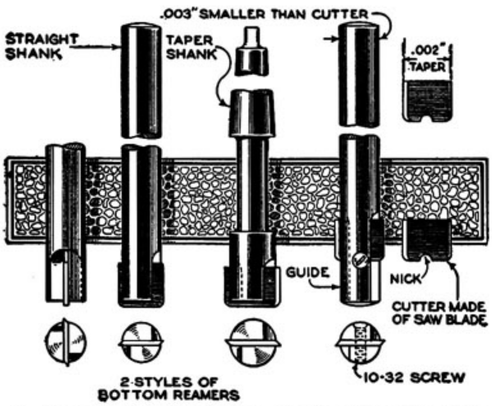
A large-sized reamer, which was to be used on a rush job, cracked in three places during hardening, the cracks being parallel with the flutes. Rather than suffer the delay of making a new reamer, it was decided to repair it. Light, strong wire was wrapped around the cracked portion to prevent further opening of the cracks, and the end of the reamer was then ground down to a diameter slightly less than the root diameter of the flutes. A steel collar was made and shrunk onto the ground seat. The temper was then drawn and the reamer ground to size. The repair was entirely successful.



¶When broaching, see that all chips are removed before placing a new piece of work on the broach.

Reaming Small Oversize Holes

On production work the oversize reaming of many small holes presents something of a problem, as the reamers wear rapidly. This wear, on expansion reamers, soon puts them out of commission, due to their limited expansion.



A Reamer for Production Work That Materially Reduces Reamer Cost and Gives Satisfactory Results

One solution of such a problem is to be found in the solid inserted-blade reamer, which uses a single blade made from high-speed power-hacksaw blades. The blade is ground accurately to size, and is replaced in a few minutes when it has worn beyond the minimum tolerance. Old blades that are worn too small are not thrown away, but are kept and ground to the next smaller size needed. The bars may have either straight or taper shanks.

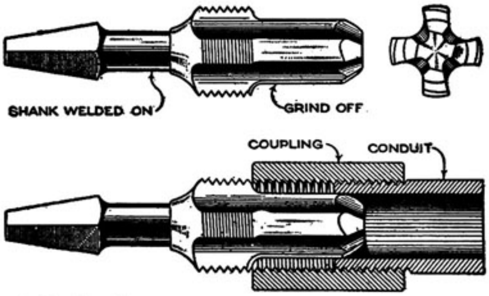
The bars are made from low-carbon tool steel, and casehardened, to prevent wear, after all machining operations have been completed. The set of a new saw blade is ground off, and this saw is used to slot the bars for the cutter blades; the bars are also milled away as indicated in the drawing, to allow room for the chips ahead of the blade.

The cutter blades are two-edged, and are ground to size at the bottom or lower end, with a taper of about .002 in.; this prevents binding or choking. These blades are held in place by making them a driving fit in the bar slot, or if a bar can be used with an extension below the cutter, a screw may be used, which should hold the bar firm at its lower end, and by grinding a nick in the blade and passing half the screw through, the blade can be prevented from shifting or pulling out when the reamer is withdrawn from the work. All bars should be slightly smaller in diameter than the minimum diameter of the hole in which they are to be used.—J. V. Romig.

Pipe and Conduit Threads Cleaned by Guided Reamer

Insulated wires which are run through metal conduits may often be injured by burrs remaining on the ends of the conduit. To prevent this, it is good practice to ream out the end of the conduit in order to remove any burr which may exist. A combination tool which does this, and at the same time cleans out the threads of the coupling, is illustrated in the drawing. The tool can be made by grinding down a standard tap, and forming, by means of the grinding wheel, the cutting edges at the end of the tap and at the forward end of the threaded portion.

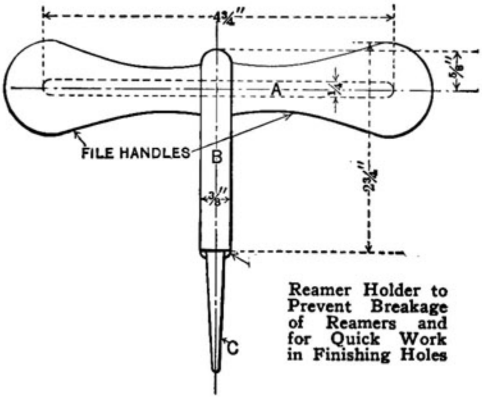
The tool is held in an ordinary bit brace by means of a shank, which can be welded onto the tap. As the reamer is fed in, the burr-removing edge at the end first does its work. The ground-down portion then runs on into the conduit, forming a guide, while the thread-cutting portion runs through the threads in the coupling, cleaning them out and straightening them, ready to take the next section of conduit. One size of reamer handles only one size of conduit and coupling, but it will pay the electrical worker to make and keep on hand tools of this type for whatever size of conduit he uses.—Eugene F. Gardner, Chicago, Ill.



A Combination of Guided Reamer and Thread Chaser, Adds to Convenience of Conduit Layer and Plumber

A Reamer Holder

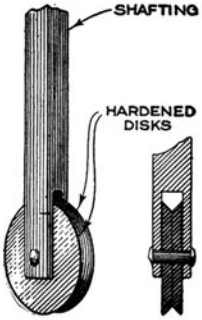
Having occasion to ream 40 taper holes daily for several months on a special job, a great number of reamers were broken in the common tap wrench. To reduce the breakage I made a holder, as shown, from two pieces of cold-rolled steel and two file handles. After cutting the pieces to the right length they were rounded on the ends, as shown, and the body B drilled, to take the reamer C and the crossbar A. The crossbar was then driven into the hole and the reamer shank soldered in place. The file handles were drilled and driven on the crossbar ends. One reamer would finish from 100 to 800 holes, and in all cases would have to be removed, on account of being worn out, and replaced with a new one.—Andrew Smith, Cleveland, Ohio.



Reamer Holder to Prevent Breakage of Reamers and for Quick Work in Finishing Holes

Rotating-Disk Reamer

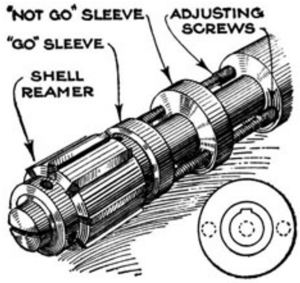
A drill or reamer, which was found useful for rough-boring cored holes, was made from a piece of shafting, slotted across its end. Two hardened steel disks were inserted so as to revolve freely on a pin which passes through their centers. These disks are ground to a bevel all around, and are inserted so that the sharp edges are away from each other. The drill is used in the same manner as a twist drill, though it cannot be used to start a hole, but only for enlarging. It is found to stand up better than a twist drill on scaly cast iron, as the cutting is done by longer edges. A hole produced by such a drill will be almost as smooth as that left by a reamer, though it will not, of course, be as straight.



¶It is well to remember, when round holes are to be accurately sized, that the properly designed round broach has demonstrated its value for this work even in comparison with roughing and finishing reamers. The work is produced at a greater speed and a considerably lessened cost for tool maintenance.

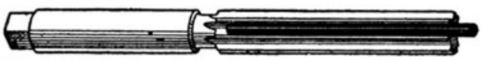
Combined Reamer and Gauge Holder

For various reasons an adjustable reamer may cut larger or smaller than the size to which it has been set. This demands careful gauging to avoid a number of spoiled pieces with a consequent loss in time. In the drawing is shown a holder that gauges the work as it is finished. The expansion-shell reamer shown is 1½ in. in diameter, and is used to ream out cast-iron rings that vary from 2 to 5 in. in width. The reamer is held in the ordinary manner, and two sleeves, or rings, are made a running fit on the holder. One sleeve, used as the "go" gauge, is left plain, the other, or "not go," is tapped for two knurled-head screws. The go gauge is always held in a position just behind the reamer, but the not-go gauge can be set by means of the knurled screws to various positions to suit the width of the rings. When the work is reamed, the go gauge enters before the reamer passes through and shows that the hole is above the low limit, and if the not-go gauge fails to enter, the hole is right. Being loose on the holder, the gauges cannot score the work, as they revolve with it. The shank of the holder as well as the gauges should be casehardened and ground to size.



Making Reamer Cut Oversize

The size of a hole that a reamer will cut may be increased by placing a piece of small round rod in one of the reamer flutes. The size cut will depend on the diameter of the rod, which should fit securely in the flute, at the same time preventing the teeth on the rod side from cutting.—J. J. Kolar, Maywood, Ill.

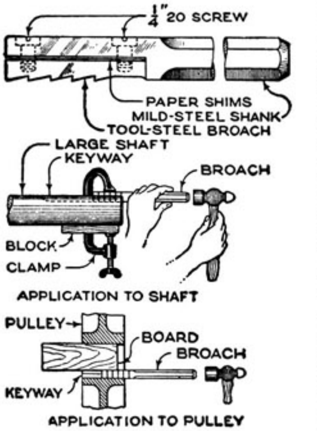


Small Rod in the Flute of a Reamer to Make It Cut Oversize

¶If kerosene oil is used when drilling, reaming, or turning malleable iron, it will make the work much smoother.

Keyway Re-Dressing Broach

When repairing or overhauling old or secondhand machinery one generally finds that the keyways are more or less banged up, and to put them into proper shape for further use they must be straightened up on the sides and fitted with new and wider keys. To dress up a damaged keyway is quite a job, and to do it properly, without taking the work to a machine shop, requires some fine, accurate handwork. To eliminate this handwork, yet obtain a perfect-fitting job, the broach illustrated was designed. The broach proper is made of good tool steel and has teeth cut on one face, as shown, ¼-in. screws holding it tightly against a mild-steel shank. The proper adjustment is obtained by the insertion of paper shims between shank and tool. The broach should be hardened and drawn to a straw color, care being taken when hardening to pack the holes in order to prevent cracking.



In actual use, select the good side of the keyway, place the face of the shank against this side, and set up the broach with paper shims until it takes a light cut. Oil the cutting as well as the rear sliding surfaces and drive it through the keyway with a hammer. If the broach has a tendency to rise, hold it down with a C-clamp, which will follow along if not screwed too tightly. Internal keyways are treated in the same manner, using a block to keep the broach down in the keyway. When fitting a key, care should be taken to have it fit well on the sides, as this is more important than having it fit at top and bottom. Rather than depend on the taper for holding the key, use a setscrew and get a good side fit.

Reaming a Large Hole with Files

A new rope drum was received for a hoist and the bronze bearings would not fit the shaft. There was nothing at hand that could be used for making the hole to the right size and a temporary arrangement had to be devised to cut out the bearings. A piece of wood was trimmed up smooth and round, and four slots cut in the rounding surface to hold four half-round files. A handle was fastened to the round piece of wood, as shown in Fig. 1. Liners were put under the files, as shown in the enlarged end section, Fig. 2, to make them cut the metal to the right size.—Geo. C. Badger, Mayger, Ore.

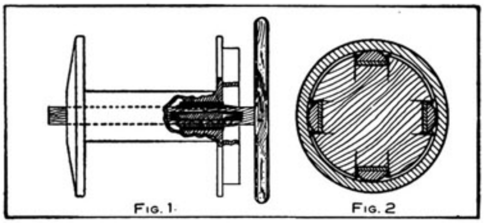
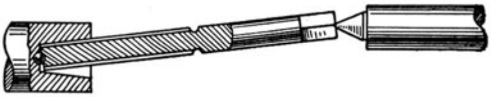


Fig. 1 Fig. 2

Position of the Files for Reaming

To Make a Taper Hole with a Straight Reamer

If no taper reamer is at hand, a taper hole can be cut with a straight reamer by the method shown in the illustration: A hole, the size of the small end of the taper hole wanted, is drilled into the work and a flat bottom cut, allowing a small portion of the drill-point depression to remain, which is drilled out slightly with a small drill to admit a steel ball halfway.



A Straight Reamer, the Shank of Which Is Offset with the Tailstock, Will Cut a Taper Hole

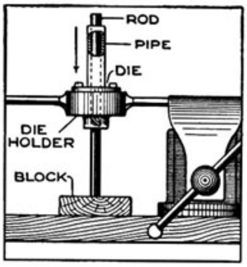
The center hole of the straight reamer is set on the ball as shown. The lathe tailstock is clamped to the ways solidly, and the holding-down bolt is loosened so that it can be crowded over with the adjusting screws to the taper required.

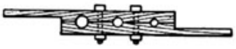
Lubricating Broaches

Square broaches should be pulled with a corner upward. The cutting lubricant then flows down around both sides, and does not spatter off, as would be the case were a flat surface used upward. Spline broaches should be so slotted that a channel between two of the splines will be on top; the channel then serves to conduct the lubricant into the hole.

Methods and Devices for Thread Cutting

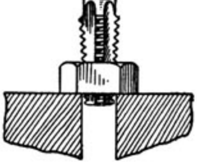
Cutting Threads Accurately on Small or Thin Pipe





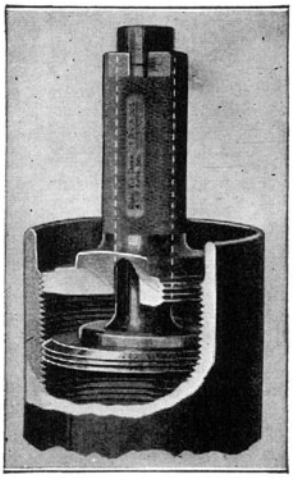
In cutting threads on thin or small pipe it is often troublesome, especially on short pieces, to get the threads square with the length of the pipe. There is also trouble in getting a suitable grip on the pipe so as not to bruise or scratch it if plated. A good method is to put the die holder in a bench vise, and reverse the dies, that is, turn them upside down. This will make a piece of pipe thread in the direction of the arrow. Select a piece of steel rod of a size to just slide through the pipe. Run this down between the dies into a block so fastened as to make the rod vertical. Slide the pipe down over the rod and it will be threaded straight and true. The best grip I have found is shown in the smaller sketch. Select a piece of hard wood, 1⅛ in. thick and 15 in. long. Shape it as shown, and bore a series of holes along a center line, of sizes to take the outside diameters of the pipes. Then bore two ¼-in. holes for bolts. With a thin saw, cut along between the pieces. When clamped on the pipe, this device will not slip or bruise it.—L. M. Drake, Daytona, Florida.

Starting a Tap True with the Work



A good method of starting a tap so that it will cut the thread square with the surface of the work, is to use a guide nut. A nut that fits the tap and has the same number of threads per inch, is faced in a lathe on a mandrel to make the surface perfectly perpendicular to the thread. The nut can then be run up on the starting tap a little beyond the first thread and when pressed to the surface of the work, it will guide the tap straight into the hole drilled for it in the piece of work.

Double-Plug Pipe Gauges for Internal Threads



For measuring the taper of inside pipe threads, a new gauge is made with an inner plug which is first screwed into the thread by hand, and over its handle an outer plug is then screwed in, both being set hand-tight. On the handle of the inner plug there is a line which, if the taper is correct, will register with the zero line of graduations on the handle of the outer plug, these graduations being spaced in divisions showing variations of .002 inch in the pitch diameter in a length of 2 inches, which is the distance covered by the gauge.

Tank for Cleaning Screw-Machine Products

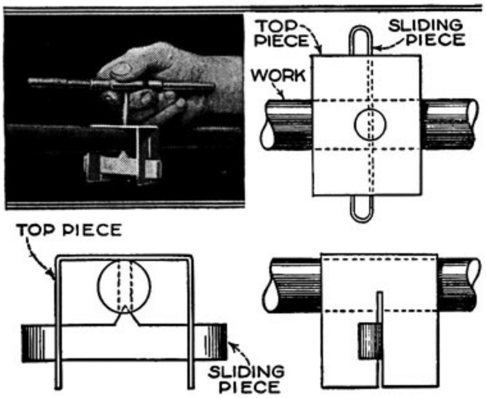
Small manufacturers not desirous of installing an elaborate system for removing the oil from screw-machine parts after completion, will find the following simple method useful: Construct a sheet-iron tank, about 24 in. deep and 24 in. square, and erect it in such a position that a steam pipe line passes through it. Fill the tank with a solution of 5 to 6 lb. common washing soda and water. It is necessary to skim the surface occasionally to remove the oily matter caused by frequent immersions in order to insure clean soda water. The solution will last some time.

Thread-Cutting Compound

A compound for lubricating thread-cutting dies and chasers, that works equally well on all kinds of steel, is made by adding four tablespoonfuls of gum camphor and one tablespoonful of sulphur to each half pint of a half-and-half mixture of lard oil and turpentine.

Tapping Round Work

It is usually more difficult to keep a tap straight and square on round work than on flat work, as there is nothing to guide the eye. The illustration shows a tap guide, made of flat stock, that aids in tapping holes straight in such work. One piece is bent at right angles on two sides, drilled with a clearance hole for the tap in the center, and a slot is sawed up each side. The second piece is made to slide up and down in the slots; the center is cut to a V-shape, and the ends are turned over to bear against the sides of the first piece so that both parts are held in line by the spring effect. To use the device as a guide it is slipped over the work and the sliding piece pushed up until the V-shaped point enters the bottom of the hole to be tapped. This movement centers the clearance hole in the top over the hole in the work, and brings the upper surface to a square position so that the tap can be guided straight with the eye. If greater accuracy is desired, a square can be used, with the stock resting on the flat upper surface of the guide.



A Simple Guide Used for Tapping Round Work Square and Straight

Restoring Crossed Threads

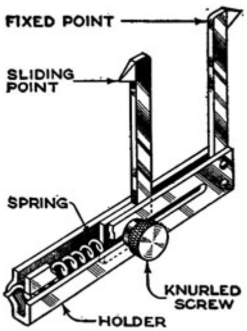
After the crossed threads of an important part of a machine have been rethreaded to function properly, they are quite likely to turn hard and have a tendency to jump back and recross. Both of these handicaps can be overcome with a little valve-grinding compound. Apply the compound to the female threads and turn the threads into one another in the same fashion as in valve grinding: a back-and-forth turning, with a little gain on the forward motion at each turn. The compound should be thoroughly removed after the threads work properly.

Counting Number of Threads per Inch in Small Holes

To ascertain the number of threads per inch in a small hole where the insertion of a pitch gauge is impossible, a stick of soft wood can be used. The stick is whittled down to make a tight fit into the hole to be checked; it is then screwed into the hole and out again, when the tops of the threads will be found plainly marked in the wood so that it is then a simple matter to count the number of threads per inch.

A Thread Cleaner

The drawing shows a handy tool for cleaning the threads of chucks, faceplates, or internal threads of machined work. When dirt or small chips of any kind become lodged in the bottom of internal threads, the result is a false fit that sometimes makes it impossible to thread two parts together, and that may spoil a piece of work that must be accurate. The tool shown consists of a fixed and a sliding point, made from ⅛-in. stock. The fixed point is riveted inside a sheet-metal channel, while the sliding point is adjustable to any diameter within the capacity of the cleaner. The channel piece, or holder, is bent in the manner shown, with a bulge on one side to permit the insertion of a spiral spring, one end of which is hooked in a hole in the sliding point, and the other around the end of the channel. The holder is also slotted at one side to clear the shank of a thumbscrew that is threaded into the sliding point.



When it is desired to clean a thread, the points are started into the thread and the spring tension serves to keep them in contact against the sides. If the thread is very tightly choked, tighten the setscrew and the tool will practically cut its way through, but for ordinary cleaning, the spring will exert sufficient tension.

Homemade Thread-Cutting Machine

By J. B. MURPHY

One of the most frequent difficulties experienced by the home mechanic, or machine operator in an out-of-the-way place is to provide an inexpensive means for threading bolts, pipes and machine parts. For such purposes a thread-cutting machine, as shown in Fig. 1, can be made, which will cut all intermediate sizes up to the largest. By using one head, all threads cut will be exactly the same. No other driving power is required than that applied with a pipe wrench.

The machine consists of a cutter head, and a vise for holding the stock. Three main parts constitute the cutter head. They are: a stationary head; a pipe or tube, attached to it and threaded with the desired master thread; and a rotating tool holder. The pipe should be of such size as to allow the largest diameter of stock to be threaded to enter freely. One end must have sufficient threads for a coupling to screw on to it completely. Two holes are drilled through the center of the pipe, at the unthreaded end, for bolting it to a wooden frame, or headstock, which, when completely assembled, is fastened to a workbench. The block is provided with a semicircular, or V-shaped, groove, to hold the pipe, and should be sufficiently high, so that the threading tools will have ample clearance above the bench. The bolt holes in the block are countersunk in the base, to admit the bolt heads.

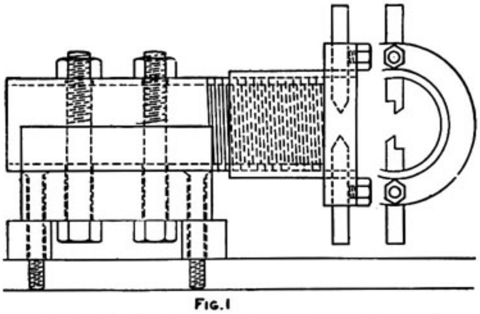
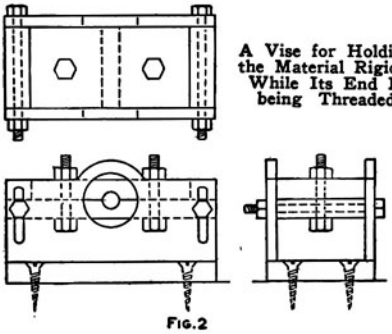


FIG. 1

An Inexpensive Machine for the Small or Home Shop to Thread Pipe or Bolts

The rotating tool holder consists of a coupling, threaded to match the pipe thread, and having a tool-holder ring shrunk on at one end. Two slots, on directly opposite sides, are cut through the ring and coupling, to admit the threading tools. Their distances from the outside face of the ring must differ by one-half the thread pitch, so the tools will track when ground exactly alike. To clamp the cutters in place, holes are drilled and tapped in the slots for setscrews.

To clamp the stock in position for threading it, any portable vise will answer, which, when bolted in place, will hold the stock so its center lines up with the center of the cutter head.



A Vise for Holding the Material Rigidly While Its End Is being Threaded

FIG. 2

If no suitable vise is at hand, a substitute can be made, as shown in Fig. 2, which will answer as well. For this purpose a strong, three-sided wooden frame is made. The intermediate piece serves as the base for the vise, and should space the two parallel sides about 2 in. apart. These should have sufficient width at the center, so that a circular hole may be cut through, having a diameter slightly greater than the largest-size stock to be threaded. The distance of the center of the hole from the workbench must be exactly the same as that of the center of the cutter head from the same base.

The clamping device consists of two iron bars, 1 in. thick by 2 in. wide. These are drilled and clamped together with two bolts and nuts, which are spaced sufficiently far apart so that the largest stock will easily fit between them, when clamped in place. A hole is drilled through the 2-in. width of the clamp, midway between the bolts and with one half in each bar. This must correspond to the smallest size of stock to be held; the larger sizes will be gripped on the four edges of the circular opening. The upper bar is only long enough to provide a bearing for the clamping nuts; the lower bar must extend out farther, so that it can be drilled at each end for adjusting bolts, which fit in slots in the wooden uprights. The completed vise is fastened in position so that it lines up as closely as possible with the cutter head, allowing sufficient space between to permit the removal of the coupling.

In using the machine, the tool holder is first turned on the pipe as far as it will go, and the stock is then set. It is clamped in the vise, with the end to be threaded extending to within a short distance of the tools. To adjust the stock centrally with the cutter head, a pair of inside calipers, or a common rule, may be used. The distances from the stock to the edge of the holes in the vise frame, should be measured, and when these are all alike, the stock is in proper alinement with the cutter head, and is fastened in that position by the adjusting bolts.

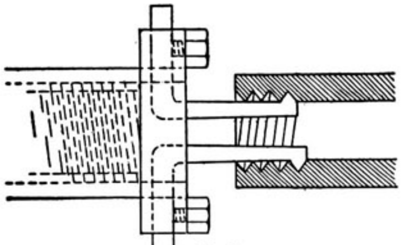


FIG.3

Cutters Used in the Head for Making Threads on the Inside Surface of a Hole

In setting the tools, the one nearest the outside face of the tool holder is adjusted first for a suitable cut in the metal. The holder is then given a half turn, and the other tool set so it will track in the cut made with the first setting, but sufficiently deep to remove an additional amount of metal. If the tools have been ground alike, not only with respect to shape but also as to length, the cuts can be determined by measuring the distances the tools project from the ring.

When all parts have been adjusted and fastened, the tool holder may be turned with a small pipe wrench, the tool meanwhile cutting and advancing along the stock with the rotated coupling. When the required length of thread has been cut, or the limit of the machine has been reached, the coupling is turned back to the starting point, the setscrews are slightly loosened, and the tools are driven in and fastened for another cut, and so on, until the thread is completed.

When cutting pipe threads, if the setscrews are loosened slightly near the end of the cut, the tools will be forced out, thereby producing the taper necessary for a tight joint.

To cut inside threads for nuts and pipe couplings, the tools shown in Fig. 3 may be used. As before, they should be alike. The cuts are produced by forcing the tools away from the center into the stock.

Lubricant for Threads in Heated Places

All nuts, cap screws, plugs and pipe fittings that are installed where they will be heated should have the threads well smeared with graphite and oil before they are screwed together. If oil alone is used, it is sometimes impossible to remove them as the oil burns out and the joints become rusty and stick.

Formula for Depth of Threads

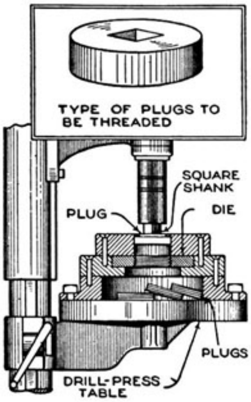
In accurate thread cutting on a lathe it is often necessary to find the depth of the threads in order to determine the proper clearance. The usual method of doing this involves considerable figuring but this can be avoided by using the simple formula:

$$\text{Depth of Thread} = \frac{.866}{\text{No. of Threads per in.}}$$

This formula is correct to within 1/100,000 of an inch, and is intended only for standard V threads. The decimal .866 is the cosine of 30°.—E. W. Davis, Chicago, Illinois.

Threading Plugs in a Drill Press

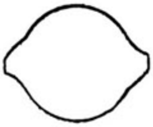
Having an order for a large number of threaded plugs, the management of a shop was "up against it" to find a rapid and economical method of doing the work until the fixture shown in the drawing was developed; this was bolted to the table of a back-geared drill press. A thread-cutting die of the proper size was mounted as indicated, and a square shank was fitted into the drill spindle, to fit the openings in the plugs. The blank plugs were inserted at the top of the fixture, and the square shank was brought to bear in the hole, pressure on the feed lever of the machine being used to run the plugs through the die; the threaded plugs dropped into the opening in the base of the fixture, in which a slot was provided for their removal.—J. H. Moore, Toronto, Can.



¶A squeaking door hinge should be lubricated with graphite and a drop of oil.

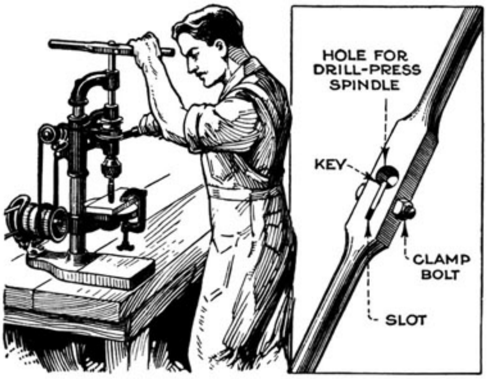
Cutting Left-Hand Screws

When left-hand screws are desired and only a right-hand screw plate is available, the left-hand plate shaped as follows will produce the threads very satisfactorily: A screw is first cut with the right-hand die and a tap made from it by cutting away the threads on two opposite sides of the metal, as shown in the sketch. The tap should be tempered and a hole of the same diameter as the body drilled in a piece of steel of the proper size. The tap is then placed in the hole and turned to the left, while applying considerable pressure. The tap should be turned slowly and the pressure applied steadily in order to insure a clean cut. If necessary the plate thus made can be shaped and slotted, after which it should be tempered. The screws cut by this plate will not be quite perfect but will do in an emergency.—J. H. Bebee, Rochester, N. Y.



Hand Tapping on a Sensitive Drill

The drawing shows an arrangement for tapping by hand, with the tap held in the chuck of a sensitive drill, the spindle being turned by a handle attachment clamped to the upper end. This method insures a true start of the tap into the hole, especially if the hole is drilled and tapped at a single setting of the work; there is also less chance of tap breakage. If much repetition work is to be done, it would be well to cross either the main drive belt or the speed-changing belt on the drill press so that the tap can be backed out by power.

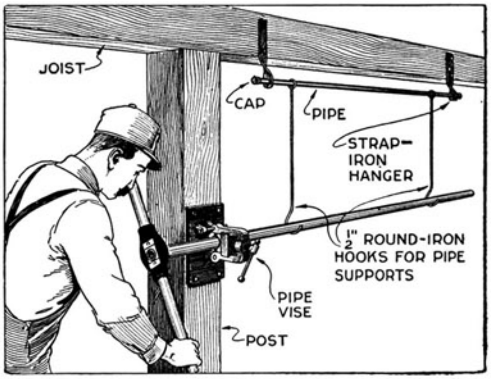


Holes Can Be Drilled and Accurately Tapped at a Single Setting of the Work in a Sensitive Drill

The handle attachment may be either a casting or forging, or it may be turned from rectangular stock. A key is provided, which fits into the spindle keyway, and the slot in the handle into which this key fits also serves to secure it tightly to the spindle. In starting the tap into the work, pressure is applied to the feed lever with one hand, while the other hand is used to turn the handle. After the tap is started, the feed handle is allowed to work freely, and both hands are used.

Hook Supports for Threading and Fitting Long Pipes

Plumbers and steamfitters frequently experience difficulty when working on long lengths of pipe because of the tendency of the long end to sag and strain the pipe vise. By providing a set of hooks, as shown in the illustration, the longest pipe may be held in the vise in an absolutely horizontal position. It will be noted that these hooks are swung on a length of pipe which is held in two straps of iron bolted overhead. Ordinary pipe caps are fitted to the ends of the supporting pipe to retain it in its fastenings. This device is invaluable for shop use, and it is not so bulky but that it may be thrown into the truck or wagon and moved from job to job.—Ross A. Williamson, Memphis, Tenn.



End of Long Pipe Is Supported by Hooks When Other End Is Placed in Vise for Threading or Fitting

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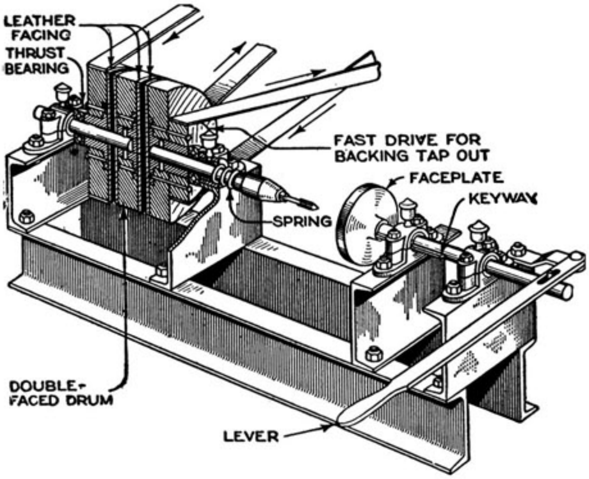
¶Should a piece become stuck on a broach during a cut, whether by breaking of teeth or by crowding of chips in the hole, chuck the broach in a lathe, and turn off the piece. If the broach has no centers, mill the piece off, or cut it in two with a hacksaw.

¶The longitudinal carriage handle should never be held in the hand when cutting threads.

A Tapping Machine for Light Work

The drawing shows a small power-tapping machine built up of 4-in. channel iron, with cast-iron bearings and a shaft about ⅝ in. in diameter.

In order to obtain the forward and reverse drive required for power tapping, a simple friction clutch is used; this consists of a double leather-faced pulley, or drum, rigidly attached to the center of the shaft. Loose, leather-faced pulleys on each side bear against the drum and, as pressure brings the faces of the separate pulleys against the faces of the drum, forward and reverse movements are obtained. Both pulleys are belted to the countershaft, one of the belts being crossed. The reverse pulley should be somewhat smaller than that on the countershaft so that the tap will be backed out of the hole at high speed. The end of the shaft is tapered and provided with a chuck, behind which a fairly stiff spring is placed, as shown, to keep the faces of the reverse pulley and drum in contact and cause the machine to run backward when not actually engaged in tapping.



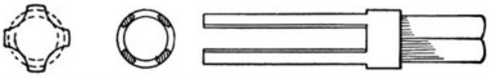
A Power-Operated Tapping Machine Which Can Be Built at Insignificant Expense, for Speeding Up the Tapping of Drilled Holes: It Is Practically Automatic

On the opposite end of the machine, a keyed shaft is supported on bearings in which it slides back and forth, the key preventing rotation; a lever, which is pivoted to the channel-iron support as indicated, is provided for moving the shaft. A faceplate, or fixture, for holding the work is attached to the inner end of this shaft.

The action of the machine is practically automatic. The work is placed in the fixture and by a movement of the lever is brought against the tap; the pressure against the tap brings the faces of the forward-drive pulley and drum together and the tap is fed into the hole so long as pressure against the tap is maintained. As soon as pressure on the lever is released the spring automatically brings the faces of the reverse-drive pulley and drum together, and the tap is backed out at high speed. For lubricating the freely revolving forward and reverse-drive pulleys, a hole may be drilled through the center of the shaft with holes at right angles for each pulley; a grease cup screwed into the end of the shaft provides the lubricant. While not absolutely essential, the efficiency of the machine can be greatly increased by the installation of ball thrust bearings, as shown in the drawing.—H. H. Parker, Oakland, Calif.

A Broken-Tap Extractor

A broken tap that is tightly wedged in the metal cannot be easily removed and sometimes even a hammer and chisel will not start it from the hole. The device illustrated can be depended upon to remove the most stubborn broken tap. The device is made of a selected piece of steel, in which a hole is bored centrally equal in diameter to the size of the tap at the base of the cutters. The outside diameter is the same as that of the drill size for the hole being tapped. The hollow part of the tool is then slotted to make four prongs that will slip into the flutes of the tap. When a tap is broken and a part of it remains in the hole the prongs of the tool are slipped into the flutes and the part removed by turning it.—Lawrence Annette, Port Huron, Mich.



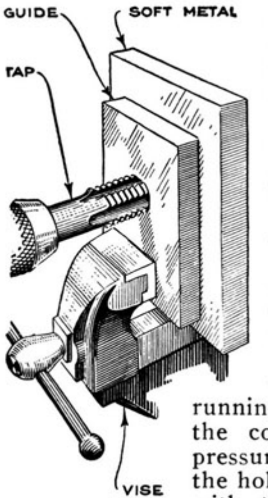
The Prongs of the Tool Are Slipped into the Flutes of the Tap for Removing It

¶A round file may be used as a reamer by inserting it in the hole to be reamed and turning to the right instead of to the left. By doing so the file will not bind and excellent work will result.

Taps and How to Handle Them

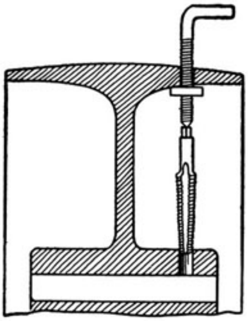
Starting Taps in Soft Metals

Tapping small holes in brass, copper or other soft metals offers some little difficulty to the amateur mechanic, as the tap is apt to ream the hole instead of cutting a thread in it. The device shown in the drawing will eliminate this trouble. A number of steel blocks, about ¾ by ½ by 3/16 in., are drilled and tapped, each for a different size. By clamping the proper size block over the hole it is desired to tap and running the tap through, the correct amount of pressure is obtained, and the hole is tapped square with the surface. The hole to be tapped may be easily located by allowing the nose of the tap to project a trifle from the guide block.—E. J. Calhoun, Chicago, Ill.



Starting a Tap in a Pulley Hub

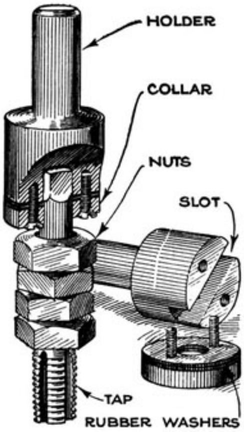
It is not an easy matter to start a short tap in a hole drilled in the hub of a small pulley. Having a number of these to tap for setscrews, I devised the tap starter shown. It consists of an ordinary bolt, of a size to pass through the drilled hole in the pulley face, and with its nut placed on the inner surface. If the bolt does not have a square or octagon head, it can be turned at right angles, as shown, to make a handle. The tap can be easily started straight with the bolt.—J. W. Madison, Oshkosh, Wis.



¶Kerosene oil is a good lubricant for reamers used in aluminum.

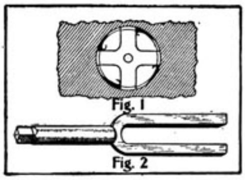
Novel Tap Holder for the Drilling Machine

Very often it is found necessary to retap large batches of nuts, which, for some reason, are too small. The holder shown is very convenient for securing and driving a tap quickly without any tightening device, thus enabling the operator to insert and withdraw the tap while the machine is running. The shank of the holder is turned to fit the drill chuck, while a slot, the width of the square on the tap, is cut across the front end. A collar is made, of the same diameter as the holder, and fastened to the latter by two screws. Between the collar and holder two rubber washers are placed. With the nuts held suitably on the drill-press table, the tap is pushed up in the holder. The rubber washers, being a wringing fit on the tap shank, will grip the tap sufficiently to keep it from falling, while the slot, of course, receives the square end of the tap shank and drives it. As many nuts as the tap shank will hold are tapped before the tap is pulled out and the nuts taken off.



How to Remove a Broken Tap

A machine tap should never be rushed, and especially when taking a deep cut. Cutting threads in wrought iron, the metal will form as shown in Fig. 1. The tap will cut its entire length if it is turned back frequently to cut off this metal. Never turn a tap by one handle of the holder, as this will cause a side strain that often breaks it. If a tap is broken off flush with the work the broken part may be removed with a tool made as shown in Fig. 2. If it will not start, heat the work with a plumber's torch.—Donald S. Stewart.



Removing Broken Taps

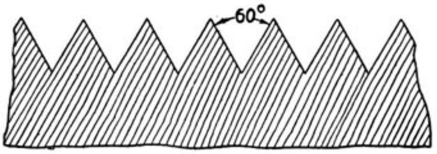
A tap, broken off in a hole, is often very difficult to remove by ordinary means; sometimes, in fact, it pays to throw away the part rather than attempt to remove the tap. But the oxyacetylene flame makes the job easy. The flame, directed against the tap, will often expand it so much that the walls of the hole are pushed back sufficiently to allow the tap to be extracted easily when cooled. If it does not, it will soften the steel so that the tap may be easily drilled out.

Chalking a Tap to Get a Perfect Fit

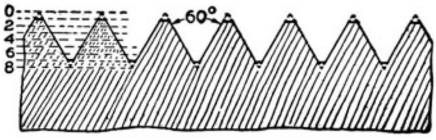
It is always desirable to get a perfect fit for steam, air, or watertight work on studs, plugs, patch bolts, and similar jobs where tapered taps are used. A simple method of determining the exact size of a tapped hole is to chalk the tap with ordinary white chalk, and then run it into the hole. When the tap is screwed into the hole the chalk is removed due to the friction of the metal against the tap. After the tap has been run in as far as it will go, it is taken out. The chalk will not show on the tap up to the point where it went in. By calipering the tap where the chalk begins the thickness of the metal around the tapped hole is determined, and the stud, plug, or patch bolt is turned up accordingly.

¶The hole in which a broach is to be started should be drilled or bored. Using a broach in a cored hole soon impairs its accuracy. The face of the work that rests against the faceplate must be true with the bore, otherwise accurate work is impossible.

A Table of Tap-Drill Sizes



Standard "V" Form of Threads

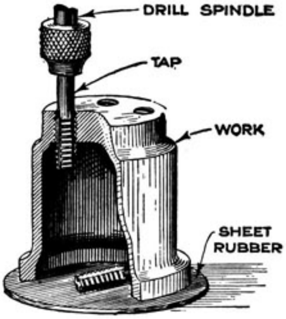


United States Standard Form of Thread

Size of Tap	Standard "V" Form of Threads		United States Standard Form of Thread	
	Threads per Inch	Tap-Drill Size	Threads per Inch	Tap-Drill Size
1-16	60, 64, 72	58, 57, 56	60, 64, 72	57, 56, 56
5-64	56, 60, 64, 72	54, 53, 53, 52	56, 60, 64, 72	53, 53, 53, 52
3-32	48, 50, 54, 56, 60	51, 50, 50, 49, 48	48, 50, 54, 56, 60	50, 50, 49, 49, 48
7-64	48, 56	44, 43	48, 56	44, 43
1-8	32, 36, 40, 48, 50	44, 43, 42, 40, 39	32, 36, 40, 48, 50	43, 42, 41, 38, 37
9-64	32, 36, 40	39, 37, 35	32, 36, 40	37, 35, 34
5-32	30, 32, 36, 40	33, 32, 31, 30	30, 32, 36, 40	31, 31, 1-18, 30
11-64	32, 36	29, 29	32, 36	29, 28
3-16	24, 27, 30, 32, 36	29, 28, 27, 26, 24	24, 27, 30, 32, 36	28, 27, 25, 24, 5-32
13-64	24, 32	26, 19	24, 32	23, 19
7-32	24, 28, 32	18, 17, 15	24, 28, 32	18, 16, 14
15-64	24, 32	15, 10	24, 32	13, 8
1-4	20, 24, 27, 32	12, 9, 7, 4	20, 24, 27, 28	11, 7, 5, 4
9-32	20	2		
5-16	18, 20, 24, 27, 32	D, 1-4, F, 17-64, I	18, 20, 24, 27	D, F, 17-64, I
11-32	18	J		
3-8	14, 16, 18, 20, 24, 27	9-32, N, N, 5-16, P, 21-64	16, 20, 24, 27	N, O, 21-64, Q
13-32	16	Q		
7-16	12, 14, 16, 20, 24, 27	P, T, T, U, W, 25-64	14, 20, 27	23-64, V, 25-64
15-32	14	W		
1-2	12, 13, 14, 16, 20, 24, 27	Y, Y, 13-32 Z, 7-16, 7-16 29-64	12, 13, 20, 27	13-32, 13-32- 7-16, 29-64
17-32	12, 13	27-64, 27-64		
9-16	12, 14, 27	15-32, 15-32, 33-64	12, 18, 27	13-32, 1-2, 33-64
19-32	12	31-64		
5-8	10, 11, 12, 20, 24, 27	31-64, 33-64, 33-64, 9-16 9-16, 37-64	11, 12, 18, 27	33-64, 17-32, 9-16, 37-64
21-32	11	35-64		
11-16	10, 11, 12	9-16, 37-64, 37-64	11, 12, 16	37-64, 19-32, 39-64
23-32	11	39-64		
3-4	10, 12, 20, 27	58, 41-64, 11-16, 45-64	10, 12, 16, 27	41-64, 21-32, 43-64, 45-64
25-32	10	21-32		
13-16	10, 12	11-16, 45-64	10, 12	45-64, 23-32
27-32	10	23-32		
7-8	9, 10, 12, 27	47-64, 47-64, 3-4, 53-64	9, 12, 14, 27	3-4, 25-32, 51-64, 53-64
29-32	9	49-64		
15-16	9, 12	51-64, 53-64	9, 12	13-16, 27-32
31-32	9	53-64		
1	8, 12, 27	27-32, 57-64, 61-64	8, 12, 14, 27	55-64, 29-32, 59-64, 61-64

Saving Time in Tapping

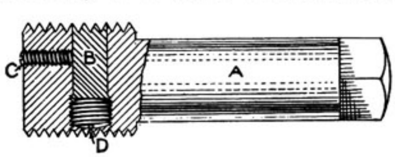
It is a well-recognized fact that a great amount of time is lost when reversing a tap after it has completed its work of cutting a thread, and this is particularly true when the holes are deep. The drawing shows how one mechanic reduced the time of a tapping operation of this character. The holes were quite deep, but, instead of reversing the tap, he allowed it to go right through, using a quick-acting chuck that released as soon as it was gripped. A rubber sheet was placed on the drill-press table, so that when the taps dropped, the edges would not be injured in any way. Of course a separate tap was used for each hole, and after each piece was finished, the operator removed them and placed them in readiness for the next piece.



An Expansion Tap

Every machinist knows that it is practically impossible to tap all holes exactly alike, unless the same amount of stock is left for the tap each time. The expansion tap, shown in the illustration, was originally designed to retap threaded holes in which varying amounts of stock had been left before the first tap had been run through.

The body A is made of machine steel, and the adjustable cutter B is made of tool steel, tempered. The hole for the cutter B is drilled before the body is threaded. The thread on the end of the body is slightly tapering, in order to insure that the tap may enter squarely each time.

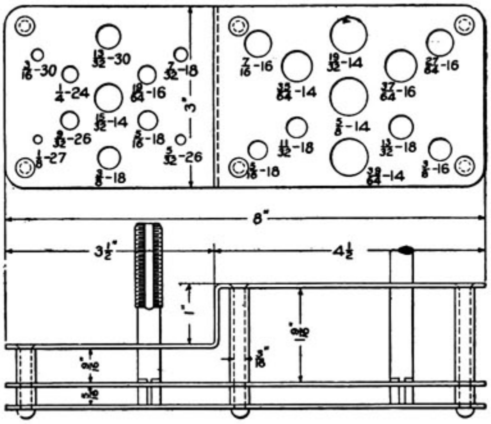


A Portion of the Threads Are Adjustable, So That the Tap Size May Be Increased

After drilling, the cutter is inserted, backed by the headless setscrew D and locked in position by the screw C. The adjustment of the cutter is obtained by the screw D. The tap will also be found useful in recutting internal threads which have become bruised.

Steel Tap Rack

A simple and compact tap rack, which can be made in a couple of hours, is shown in the accompanying sketch. It will prove to be a time as well as a trouble saver, and being made of steel, it is well able to stand the rough usage to which all shop tools are subjected, and consequently very durable. Each hole in the top plate should be marked with the number of threads and the size of the tap it is intended to hold. The holder can be made larger or smaller than the one shown, but this size will be found about correct for the ordinary shop.—C. A. Allen, Linwood, Massachusetts.



Details of Tap Rack

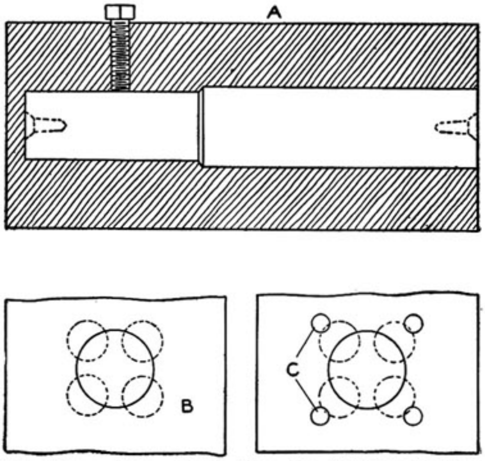
Greater Speed Is Claimed for Spiral-Fluted Tap

A staybolt tap that has proved a success after most exacting tests is machined with spiral flutes. It is designed with a taper that has proved to have a distinct advantage over the common tapers, adding greatly to the life of the tool. The spiral flutes provide free cutting edges, thus enabling the tapping speed to be increased without increasing friction. The results of the tests indicate that the new tap will do more work, in less time, than any other form of tap.

¶Use plenty of good lard oil when cutting threads on steel.

Fluting Taps on a Drill Press

It often happens that a tap must be made for some special job and where there is no milling machine the flutes can be cut on the drill press either before or after threading the steel. The manner of doing this is as follows: Drill a piece of metal, as shown in A, the size and shape of the outlines for the finished tap. Drill and tap a hole for a setscrew, as shown.



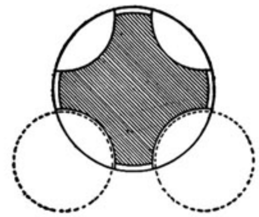
The Shape of the Metal Piece for Holding the Tap Blank to Be Fluted with a Drill

The flutes are cut with a twist drill, and the right size to use in making a 1-in. tap is a ½-in. drill. For other sizes increase or decrease the size of drill as necessary to make the flute the proper depth. The end of the metal is laid out as shown in B. If the metal is cast iron, small holes should be drilled and steel pins inserted, as shown at C, on the line of the outer edge of the four circles. These pins should be a driven fit. The blank piece for the tap should be turned up straight to fit the hole drilled for it in the block, then, after drilling the flutes, it is shaped as desired. Four holes drilled as shown cut the flutes in the metal of the tap.—J. F. Tholl, Detroit, Mich.

Two Ways of Spoiling Taps

Taps are rather delicate tools, as every metal worker knows to his sorrow. There are two ways, among many others, in which taps are often rendered useless. One is to turn them with a monkey wrench instead of the regular tap wrench. This results in applying pressure at one side, and brings a bending strain on the tap, which very easily breaks it. The other is to use taps in cored holes in castings without first cleaning out the holes with a flat drill to take off the hard, gritty scale. This scale or skin is exceedingly hard on cutting tools of all kinds.

Removing a Broken Tap

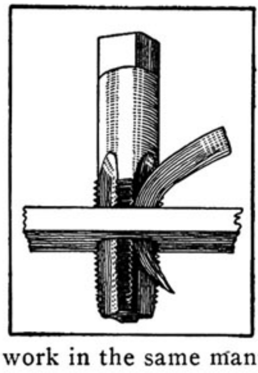


When a tap breaks off inside a hole, especially if the metal being tapped is iron or steel, it is quite a job to get the broken piece out of the tap. Often the most practical method is to soften the piece with a blowtorch in order to drill it out, but this method is by no means reliable.

Where it is possible to use the part with a larger screw than had been intended, a good method of extracting the tap fragment is shown in the diagram.

Drill two smaller holes as indicated by the dotted lines, so as to fit into the flutes of the tap. After these holes are made, it is comparatively easy to knock the fragment around far enough so that half of the cutting edges of the tap come into the two holes, thus loosening the piece entirely. It can then be lifted or dropped out. It is now necessary to run a larger-size drill down the hole and retap it, substituting a screw of appropriate size.

Making a Tap Cut Larger than Its Size

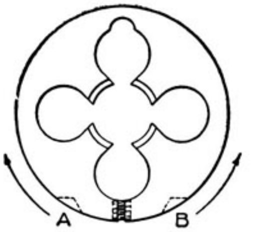


If a tapped hole is too tight for a stud, or bolt, cut a small strip of sheet copper and insert it in the flute of the tap, as shown in the illustration. This will crowd the tap over to one side, which makes a larger threaded hole. This will work in the same manner on reamers.

¶When broaching soft, "stringy" steels, they often tear out at the edge of the hole. This can be prevented and the finish improved by heat treating, so that a scleroscope reading of from 25 to 30 is obtained.

Dies and How to Handle Them

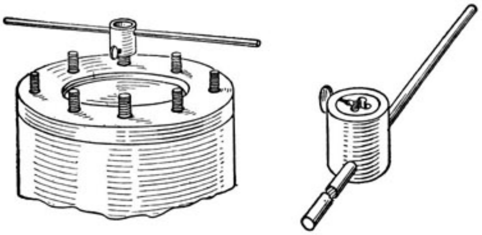
Correct Way to Use a Die



There is a right and a wrong way to use dies as with everything else. You have perhaps noticed that a die seems to work harder and to dig up the threads more at one time than at another. This refers to the round solid type that is split on one side and has a round countersunk hole on each side of the split to receive the driving screw from the diestock. If the screw is put in hole A when run on the work and in hole B when backing off, a big difference will be observed. A moment's thought will convince you that this is the logical way, as the natural drag of the die will keep the side opposite the screw from pulling in on the work, and the position of the screw keeps its own side from crowding.—D. A. Hampson, Middletown, N. Y.

A Special Die Holder

In some instances it becomes necessary to rethread a stud so placed that it is impossible to get at it with an ordinary die stock. A stud on a cylinder head, for instance, where there are several located, will require a special die holder to turn the die on the stud that needs a new thread. Many times the threads on these studs become bruised or battered in making repairs, and then, too, it may be necessary to reduce the size of the stud to fit some other nut. A special die holder for rethreading these studs is made of a piece of steel or cast iron, bored at one end to receive the die and drilled for a thumbscrew. The piece may be of any length and a rod run through a hole drilled in the end opposite the die for a handle.



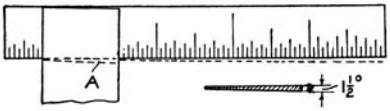
Long Head Diestock for Use in Cutting Threads on a Stud Surrounded by Others

How to Recut Threads on Small Machine Screws

It is often necessary to cut or rechase threads on small screws and in doing so, if the screwhead is placed in a vise it is almost sure to spoil the screw. Change the operation by placing the diestock in the vise and running the screw through the die with a screwdriver. This will always save the finished screwhead.

Square Attachment to Determine Die-Clearance Surfaces

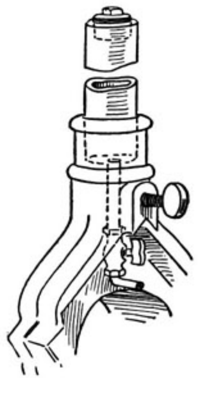
In filing the clearance in dies, all cutting surfaces may be accurately determined by using the attachment shown in the sketch on a square. It is made of a piece of metal as long as the post of the square is wide and filed to an angle of 1½°, then fitted to the slot A in the post of the square. The wedge thus formed is used beneath the edge of the square blade to give it the proper slope for testing the edge of the die.—J. F. Tholl, Detroit, Mich.



The Slope of the Blade Produced by the Wedge Is Just Right to Test the Die Edges

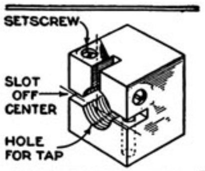
Oiler on a Diestock

Plumbers always do most of their work on the job wherever it happens to be, and it is, therefore, difficult to keep an oilcan handy and filled with oil for lubricating the threads of the die. For this reason I provided an oil reservoir in one of the handles on my diestock, with ⅛-in. pipe connections at the end near the die and a pet cock fitted in it for regulating the flow of oil. The illustration shows the connection. Only a few parts are required to have this oil supply always at hand, and one filling will last a long time.—E. I. Beicher, Marion, Ohio.

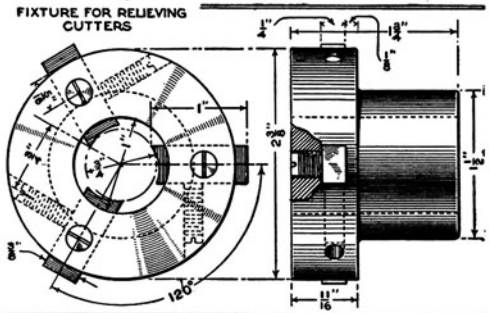


An Inserted-Blade Die

Upon receiving an order for the manufacture of several thousand parts of ¾-in. stock, with a threaded end, about 1 in. long, 20 threads to the inch, the work was undertaken with a commercial carbon-steel button die, held in the regular holder of a tapping machine. It was soon discovered that these dies quickly lost their size, and that they were difficult to sharpen and adjust; these defects led to the development of the inserted-blade die shown in the drawing. The important feature of this die is the high-speed steel cutters, each of which is held in place with two ¼-in. setscrews. The cutters are made of ¼ by ⅜-in. stock, inserted in the body 120° apart, thus making a three-blade die.



FIXTURE FOR RELIEVING CUTTERS



A Simple Inserted-Blade Threading Die Is Particularly Adaptable for Production of Work in Quantities

To make the cutters, the annealed stock, 1 in. long, was inserted in the holder and, after chucking in the lathe, was run onto a trap held in the tailstock. The die was then put into the relieving fixture shown, which throws the tap off center, and the tap was again run through, thus relieving the cutters. This relieving fixture is simply a hardened bushing with the hole for the tap off center, and with three slots cut into its face for the insertion of the blades. After the cutting blades are relieved, they are hardened at a temperature of 2,200° F., drawn down to 600° F., lapped to remove the scale, and inserted into the holder. The blades are adjusted on center by setting them up against a piece that has previously been threaded. With this inserted-blade die, the production jumped to 180 pieces per hour, and the die would cut about 500 pieces before sharpening was needed; when this became necessary, the blades were sharpened by grinding across the cutting face.

Thread-Cutting Dies

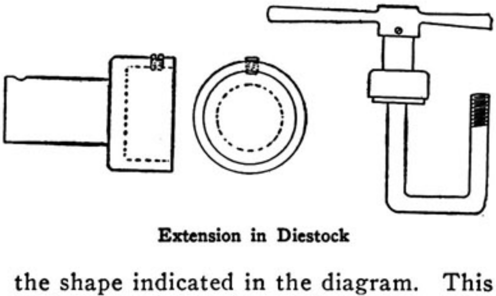
Thread-cutting dies cannot be expected to cut cleanly and well without rake. This rake or lack of it makes quite a difference between a cutting die and one that only scrapes the metal off. The cutting edge of each "land" of the die should be made an acute angle with a line passing through the center of the work and through the extreme point of the cutting edge. Avoid dies that cut both ways. Such dies do not cut cleanly or easily when either face is to the work and they must of necessity drag the idle cutting edges over the work and dull them. One set of bolt dies that had the cutting edges parallel to the center line, or rather if continued would form the centerline, never cut so well as might have been expected. They were ground out so that the cutting edge had rake and after that they always cut nicely.

Threading Die Made from a Nut

A nut which has a well-cut thread can be transformed into a die by filing four or five notches in the threads of the nut with a round or three-cornered file, backing off the cutting edges with a larger round file, and then hardening the improvised die. The notches can be cut more effectively with a drill press if one is available; first screw a threaded stud into the nut, and then drill small holes around the circumference of the stud, half in the stud and half in the nut. Remove the stud and touch up the holes with a file. If the stud sticks in the nut, it can be loosened by drilling a hole through its center.

Diestock Extension

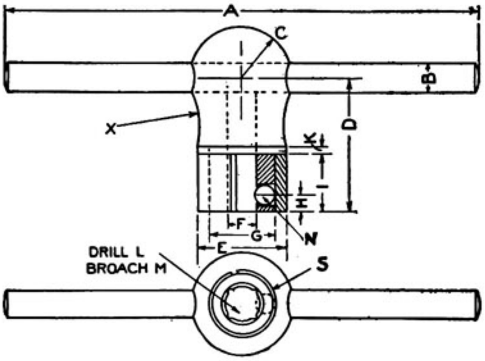
In the sketch is shown an extension for a diestock for threading the ends of U-bolts. It is turned from machine steel in the shape indicated in the diagram. This tool is especially adapted for making clips for automobile springs.—Urban A. Towle.



Extension in Diestock

Tap Wrenches

A design of tap wrench which will hold taps so that they cannot drop out when removed from the work is shown in the accompanying sketch; and the table gives the sizes for a set of wrenches taking taps from ³⁄₁₆ to ⅝ in. inclusive.



Design for a Tap Wrench to Be Made in Any Size Shown by the Reference Letters in the Table

The construction of this wrench is as follows: The body is turned, drilled and reamed for the handle, the hole is also drilled and later broached out, to take the square part of the tap shank. After broaching, a small hole is drilled for the locking ball N. This hole should not be drilled entirely through, and enough stock should be left at the inner edge to keep the ball from passing through and dropping into the broached hole. The inside face of the ball strikes the flat on the shank of the taps and the ball is held against that part by the pressure of the spring S against its outside face.

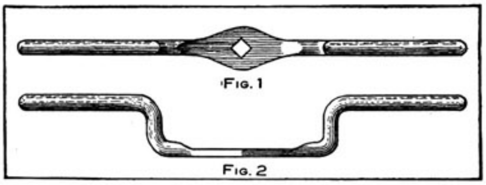
With the use of this wrench, all three taps of a set can be run through, one after another, and the operation of changing the taps simply consists in pulling the wrench off the tap shank and pushing the square of the second tap up into place, where it is held by the action of the spring against the ball.—Chas. F. Scribner, Hartford, Conn.

Tap Wrench Aids in Using Breast Drill

When drilling with a breast drill, to overcome the catching of the drill that necessitates backing it up, the following remedy is a good one: Take a tap holder from a set of taps and dies, slip the shank of the drill through the tap holder, and tighten down as when holding a tap. Allow enough of the drill shank to stick through to engage in the drill chuck. The tap holder now acts as a flywheel and the centrifugal motion carries the drill past the little catches unnoticed; the drilling is thus made much easier.—Orin C. Watkins, Salem, Ore.

An Offset Tap Wrench

Occasion may demand the tapping or reaming of a hole that is so located as to cause the handle of the holder to strike some projecting part before the tool cuts through the metal. In such a case, procedure is impossible, unless a part of a turn is taken and the wrench then changed. The accompanying sketch illustrates a wrench that is quickly made from ⅝-in. round steel which can have sufficient offset for the handles to be out of the way when turning taps or reamers in recesses. Figure 1 illustrates the plan and Fig. 2 the elevation of the wrench. The edges of the ¾-in. square hole can be hardened and a set of bushings made from sheet metal to place in the hole that will hold taps in sizes from ¼ to ¾ in. A mechanic will find this a very useful addition to his kit of tools.—Donald A. Hampson, Middletown, N. Y.



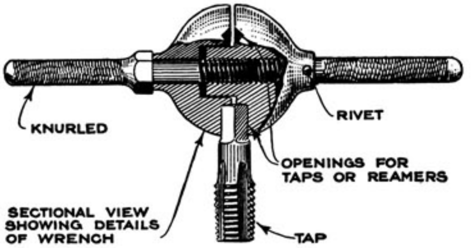
The Wrench with Offset

SIZE	A	B	C	D	E	F	G	H	I	K	L DRILL	M SQ	N BALL	X
³⁄₁₆.........	5	¼	¹¹⁄₃₂	¹⁵⁄₁₆	½	.190	.420	⅛	⅜	¹⁄₁₆	⁵⁄₃₂	.143	⅛	...
¼	7	⁵⁄₁₆	¹³⁄₃₂	¹⁵⁄₁₆	⁹⁄₁₆	.260	.484	⅛	⅜	¹⁄₃₂	¹³⁄₆₄	.194	⅛	...
⁵⁄₁₆.........	8	⁵⁄₁₆	¹³⁄₃₂	¹⁵⁄₁₆	⅝	.295	.540	⅛	⅜	¹⁄₃₂	¹⁵⁄₆₄	.220	⅛	...
⅜	9	⅜	¹³⁄₃₂	¹⁵⁄₁₆	²¹⁄₃₂	.320	.585	⅛	⅜	¹⁄₃₂	¹⁷⁄₆₄	.240	⁵⁄₃₂	...
⁷⁄₁₆.........	9¾	⁷⁄₁₆	⁹⁄₁₆	1 ³⁄₁₆	²³⁄₃₂	.345	.633	⁵⁄₃₂	⁷⁄₁₆	¹⁄₁₆	⁹⁄₃₂	.258	⁵⁄₃₂	...
½	10½	½	⁹⁄₁₆	1 ³⁄₁₆	¾	.375	.660	⁵⁄₃₂	⁷⁄₁₆	¹⁄₁₆	⁵⁄₁₆	.278	⁵⁄₃₂	...
⁹⁄₁₆.........	12	⁹⁄₁₆	⁹⁄₁₆	1 ¼	²⁵⁄₃₂	.435	.720	⁵⁄₃₂	⁷⁄₁₆	¹⁄₁₆	¹¹⁄₃₂	.325	⁵⁄₃₂	...
⅝	15	⅝	⁹⁄₁₆	1 ⅜	²⁷⁄₃₂	.485	.770	⁵⁄₃₂	⁷⁄₁₆	¹⁄₁₆	²⁵⁄₆₄	.360	⁵⁄₃₂	⁹⁄₁₆

Each Size of Tap Is Driven by a Wrench Whose Dimensions Are Given by the Reference Letters at the Heads of the Columns, Which Correspond to Those in the Sketch

An Improved Tap and Reamer Wrench

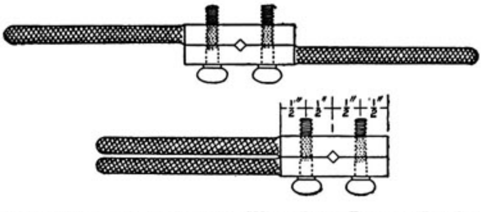
A navy-yard machinist uses a tap and reamer wrench of his own design which is a departure from the usual type, as shown in the drawing. The central portion of the wrench is made spherical in shape, to afford a convenient grip for the palm of the hand when starting a tap into the drilled hole, thus making it possible to hold the tap centrally and causing it to take hold readily without tearing out the uppermost thread. Six openings for the accommodation of different-sized tap and reamer shanks are provided around the periphery, and the wrench can be used for holding almost any tap or reamer.


KNURLED
RIVET
OPENINGS FOR TAPS OR REAMERS
SECTIONAL VIEW SHOWING DETAILS OF WRENCH
TAP

A Tap and Reamer Wrench Which Affords a Comfortable Grip for the Hand in Starting the Tool

A Tap Wrench

The parts are each shaped from ¾-in. cold-rolled square, about 6 in. long, the handles being turned round for about 4 in. of their length. The square parts of both pieces are clamped together and holes drilled and tapped for ¼-in. bolts. The holes should be accurately drilled so that, when the pieces are turned as shown in the lower part of the sketch, they will form a single-handle wrench. — E. H. Wolever, Norristown, Pa.

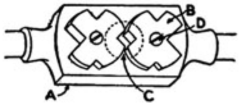


Adjustable Parts for a Tap Wrench to Form a Double or Single Handle

¶Where oil will not act as a cooling agent on a drill working in hard metals, turpentine used instead will permit the drill to take hold and retain its temper.

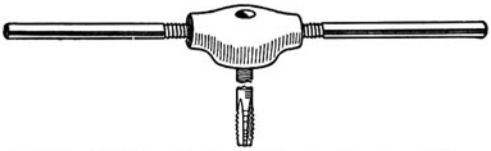
An Adjustable Tap Wrench

A very efficient tap wrench, that answers the purpose well, can be made as shown. A piece of cold-rolled steel, A, about ⅜ in. thick and 1¼ in. wide, is cut long enough to allow two round disks, about ¼ in. thick and 1 in. in diameter, to be fitted on it. Notches are cut or filed into the disks B so that, when two notches of equal size are opposite each other, they form a square opening. The disks revolve freely on the screws D, which are turned into the plate A. A hole, large enough for the largest tap, is drilled at C. Handles are attached to the holder ends as shown. When a tap is in the notch the disks cannot turn.



Individual Tap Holders

Where a number of taps of different sizes are used I found that changing the taps in the holder not only consumed considerable time but was very annoying besides. To overcome this difficulty I made a holder for each tap. A pattern was made of a piece of white pine, and from it I had a dozen castings made in gray iron at a slight cost. The ends were bored and tapped to admit a 4-in. bolt of small diameter—one at each end. The heads were cut off and the ends filed round. A hole was drilled into the body of the casting at right angles to the line of the bolts. This hole was of the same size as for the tap used. Each holder was drilled for its tap. The tap is held rigid by screwing the bolts up against the square end.—Jas. A. Hart, Philadelphia, Pa.



Individual Holders for Taps Where a Number of Them Are in Use from Time to Time

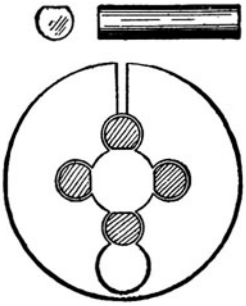
¶Never take it for granted that a reamer will ream to size.

¶An improvised thread gauge for measuring female threads is made by turning a soft wooden dowel into the thread. The resulting marks on the wood are then used to determine the number of threads to the inch.

Unusual Drilling and Thread-Cutting Jobs

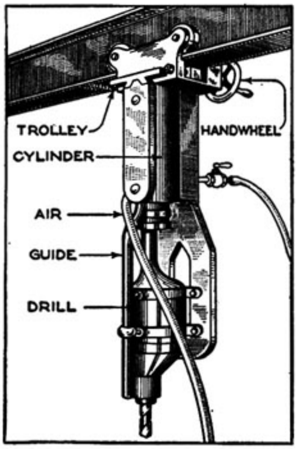
Retapping a Die

When a die becomes worn so as to cut a ragged thread, anneal it, close the die down and fill the open spaces with plugs as shown. Each plug should have a flat surface toward the center of the die. Tap out the threads the same as tapping a hole, remove the plugs and temper.—J. F. Tholl, Ypsilanti, Mich.



Drill Mounted on Air Cylinder

A west-coast shipyard makes use of a rather novel mounting for electric and air drills used in drilling ship and boiler plates. The drill is mounted on the end of the piston of an air hoist, being guided on one side by a round spindle flattened at one end and bolted to the cylinder, and on the other by flat guides bearing on a special bracket, which is slotted to allow the drill handle to project.

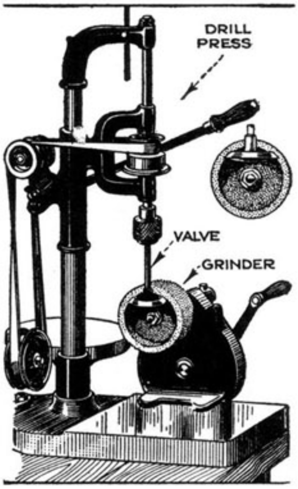


The cylinder is carried by a trolley running on an I-beam, which swings radially so as to cover a wide plate. A handwheel and screw on the trolley enable the operator accurately to adjust the lateral motion of the drill. Two or three drills are suspended from each beam, thus making rapid production possible. Feed and withdrawal of the drill are effected by means of the air cylinder.

¶Never guess the number of threads to be cut, count them.

Facing Valves on Drill Press

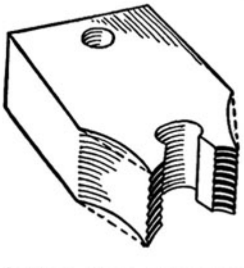
A novel method of refacing valves is shown in the illustration, a drill press and a hand grinder being used to do the work. A cupped emery wheel is fitted on the grinder, and the valve face is ground with the inner surface. This makes the face round, which, by many mechanics, is considered superior to a flat face, as it seats more readily and uniformly, and the smaller contact surface removes all carbon particles that become lodged on the seat.



The grinder is revolved with one hand while the drill-press spindle is lifted to bring the valve face in contact with the inside surface of the emery wheel. In grinding, only the smallest possible amount of metal is removed from the valve, and therefore the valve must not be held on the wheel for any considerable length of time.

Grinding Dies

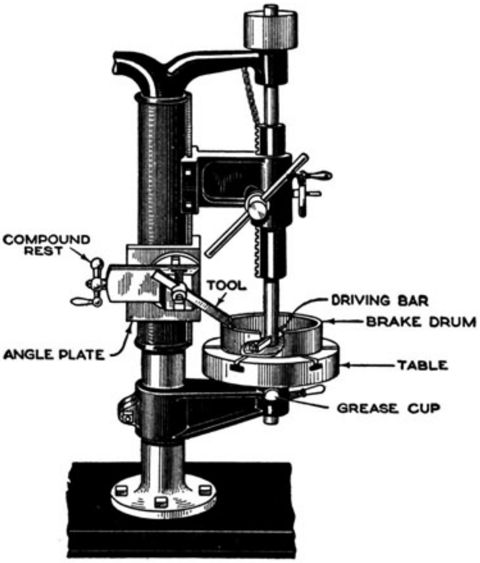
A set of dies that had been ground as shown by the dotted lines in the sketch were thrown away as worn out. I picked them up and ground them concave and they seemed to cut better than when they were new.—L. H. Atwell, Atlanta, Ga.



¶As a broach becomes dull, a tendency to drift may develop. This is overcome by sharpening the teeth on the opposite side to that toward which the broach tends to drift.

Turning Brake Drums in the Drill Press

A small automobile shop, having a number of brake drums to be faced, and having no lathe large enough to swing them, solved the problem as shown in the drawing. A groove was cut in the arm supporting the drill-press table, and a grease cup fitted to provide for lubricating the table arbor. The clamp on the latter was loosened so that the arbor was an easy-running fit, and a brake drum clamped centrally on the table.



By Rigging a Drill Press as a Boring Mill, a Rush Job of Facing Brake Drums Was Turned Out Satisfactorily

The drill spindle was run down to the drum, and a flat bar of steel slipped through the spindle slot, engaging with two of the bolts clamping the drum. On the vertical table slide, a small angle plate was fastened, and on the plate, a compound rest was mounted in the proper position to feed across the work. By feeding the tool across the work by hand, while running this drill press at its slowest speed, the job was turned out in very good time considering the handicap.

Balancing Rotating Machine Parts by Drilling

In spite of careful machine work, rotors made in a shop where there was no machine for balancing machine parts precisely were found to be slightly out of balance. This was remedied by mounting the rotors on a pair of parallels, having knife-edges. After the light side had been determined, a small hole was drilled in it, and a pin inserted. Washers were put on the pins until a balance resulted. The amount of metal to be removed from the opposite side by drilling small holes was thus determined accurately, and the exact point at which this could be done handily was also found. — Clarence Anderson, Worcester, Mass.

Cutting Threads with a File

Having to repair some farm machinery about 10 miles from a machine shop, we had to shorten a 1-in. bolt about 4 in. This meant cutting off the threaded part and making new threads on the smooth shank of the bolt. The only tools at our command were a vise and some files. The problem was solved in the following manner:

A piece of paper, about 1½ in. wide, was cut so that the edges would meet when it was wrapped around the bolt. Eight threads per inch being the standard for a 1-in. bolt, the paper was laid out in eighths, as shown in Fig. 1. It was then pasted around the bolt, as in Fig. 2, the thread being correctly indicated by slipping one edge of the strip forward one division.

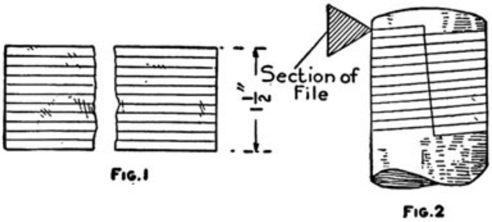


FIG. 1

FIG. 2

Marking the Threads

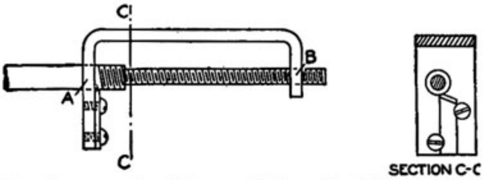
The threaded end of the bolt having previously been cut off, the new threads were cut by following the lines on the paper with a three-cornered file. The depth of the threads was tested by following the file with the nut as the threads were cut.

The thread thus made was not comparable with one made by the dies, but it was good enough to answer the purpose.— Arthur D. Johnson, Philadelphia, Pa.

Cutting Special Threads without a Lathe

To make a screw on a rod or shaft of any diameter using only a standard thread cutter, proceed as shown in the sketch. A piece of flat iron is bent and drilled, at A, to receive the shaft, and tapped, at B, with a standard thread of the required pitch. A thread-cutting tool is made of flat tool steel, ground to a 60° cutting point and clamped to the flat iron with two screws, as shown.

The shaft on which the screw is to be made is turned down at the end and a standard thread cut on the end. The shaft is then inserted in the large hole in the flat iron and turned into the threaded hole, which causes a thread to be cut on the large part. A better thread can be made by taking several light cuts. The end with the standard threads is cut off, leaving only the special thread on the shaft.—Phillip K. McGall, W. Orange, N. J.

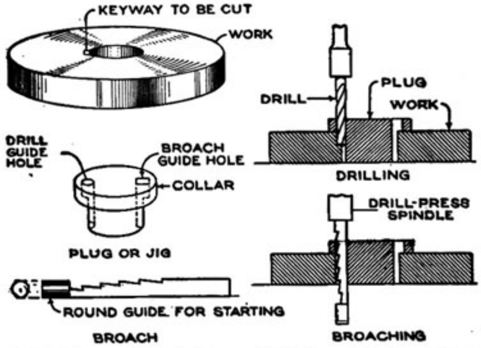


The Standard-Size Threads Make a Feed for the Tool Which Cuts the Threads on the Large Part

Keyway Cutting with a Drill Press

The sketch illustrates a method by which a drill press was used to cut keyways in a number of circular plates. The work was found to be quite accurate, although the operator was not a skilled machinist.

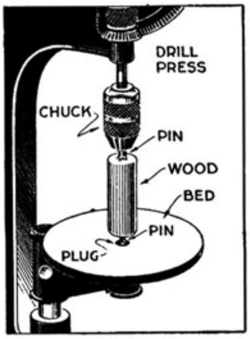
A jig is first made in the shape of a plug to fit the hole, having a collar or shoulder at its upper end. Through this shoulder two holes are cut, one round and one square, each being complete in the collar, and being continued as a slot down the body of the plug. The round hole is made to serve as a guide for a drill, and the square one for a broach. The work is first set up in the drill press, as shown at the upper right, and the drill is run through, resulting in a semicircular slot in the work. To square out this slot, the plug is turned so that the square hole comes directly over the slot, and the special broach illustrated is run through. The hand feed of the drill press is utilized for forcing the broach through, as suggested at the lower right. A single broach is found sufficient, as most of the metal is removed by the drill.



A Workman without Great Skill Can Cut Good Keyways on a Drill Press, by Use of a Special Jig

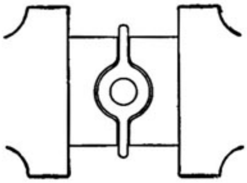
Using the Drill Press as a Wood-Turning Lathe

In shops unprovided with facilities for turning wood, there is frequently demand for work requiring a fairly accurate cylindrical outline. Such work may be turned out on a drill press. Two stout pins are driven in the ends as nearly in the center as possible. One of the pins is secured in the chuck while the lower one is given a bearing in one of the holes of the drill table. A suitable tool rest is provided by an ordinary machine clamp, while an old bastard file, ground off, sharpened, and provided with a handle, makes a satisfactory cutting tool. The size of work that may be turned out in this manner is limited only by the size and adjustments of the drill press.—J. S. Hagans, Toledo, Ohio.



Tapping Wing Nuts

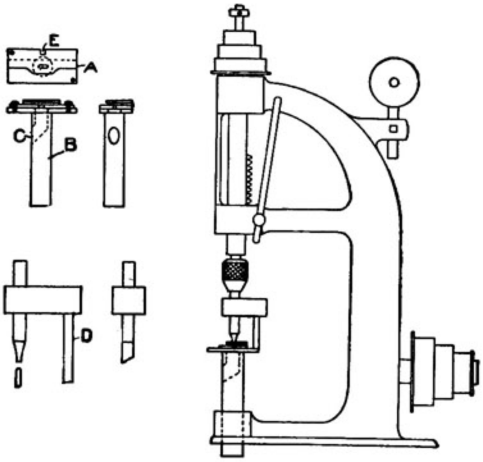
In tapping wing nuts, provide a holder as follows: Procure a square or hexagon nut having a hole 1/16 or 1/8 in. larger than the outside diameter of the wing-nut body. Saw the nut in two and use it in the vise jaws as shown.—John P. Kolar, Ithaca, N. Y.



¶A tap should never be used to clean a hole in hardened work, even if the work is soft enough to be scratched with a file.

Drill Press Used for Light Punching

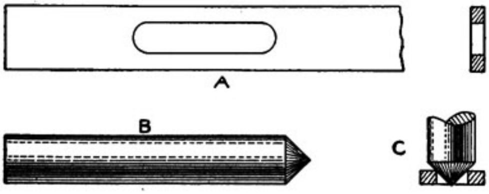
Having a number of oblong holes to punch in some thin brass strips, I devised a die that was used in a drill press in the manner of a hand bench punch. The die and guide plate A was fastened to a stem, B, that was turned to fit the hole in the drill-press standard. The stem was drilled, as shown by the dotted line C, for releasing the punchings. The guide D passes through the slot E in the die A, so that the whole device may be readily set in the drill press and the punch coincide with the die.—A. G. Sherk, Irvington, N. J.



A Die Fitted in a Drill Press for Punching Oblong Holes in the Brass

A Burr-Removing Tool

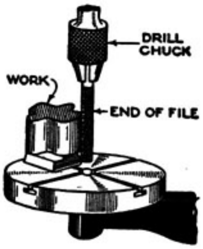
Several thousand slots were punched in steel strips, one of which is shown on the sketch at A. The burr at the ends of the slots, though slight, was objectionable and it was desirable to have the edges slightly rounded. To take off the offending sharpness a piece of drill rod, B, was beveled on the end to 45°, then the beveled end was ground on a coarse emery wheel while the drill rod was rotated. This produced small cutting edges on the roughened surface, which, when hardened, proved very lasting. The cutter was placed in a fast-running drill, the slotted steel strips, held in the hands, were pressed lightly against the revolving tool C and moved lengthwise. The burr and sharp corners were thus effectively removed.—Donald A. Hampson, Middletown, N. Y.



Tool for Removing the Burred Edges on a Slot Punched in a Metal Strip

Filing in the Drill Press

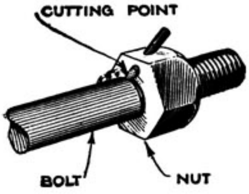
When peculiarly shaped punches are to be filed, much time may be saved, where a filing machine is not convenient or available, by utilizing the drill press. The drawing shows the method followed; a piece of a round file, of a cut suitable to the degree of finish desired, is held in the chuck, and, while the file revolves, the work is pressed against it.



One advantage of this method is that the sides of the piece being filed are kept parallel, while, if a taper is desired on the work, this may readily be obtained by the use of properly tapered packing pieces, on which the work is held.

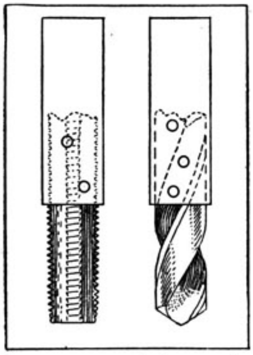
Thread-Cutting without a Die

When an additional length of thread is wanted on a bolt and no thread-cutting die is at hand, the work can still be done. On one of the faces of a nut that fits the bolt, drill a hole, proportioned to the size of the nut, at such an angle as to come out just above the threads on the bolt. A steel pin is ground to a point, so as to fit into the threads of the bolt when placed at the angle in which the hole is drilled. After providing proper clearance on the tool and tempering the point, drive it into the hole, allowing it to project so that it will cut but a part of the thread until the correct angle is obtained; then drive it on until it is in a position to cut the full thread as the nut is turned. The same method can be used for cleaning out bruised and rusted threads and, by using



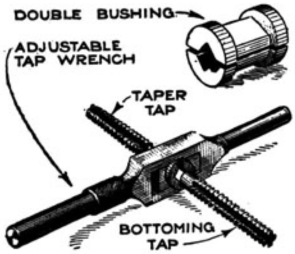
a flange in place of the nut to hold the steel pin, the same effect can be obtained on pipe.—G. G. McVicker, North Bend, Nebraska.

How to Use Broken Taps and Drills



The short end of a tap or drill that has been broken can be used again with a device as shown in the sketch. It consists of a piece of brass or iron tubing which has several holes drilled in the sides at one end where the broken tap or drill is to be inserted. A sheet of paper should be wrapped around the tubing covering the holes, and the end of the tube beyond the broken tool filled with a wood plug. Melted babbitt is then poured into the tube around the broken tool. The holes that are drilled into the tube will anchor the babbitt and keep it from turning. The broken tool should fit the hole of the tube very close.—Rockford Drilling Machine Co.

One Wrench for Two Taps

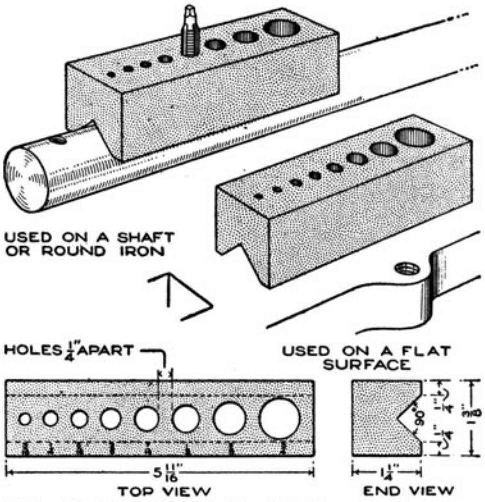


By using a supplementary double bushing, of the type shown in the drawing, and placing this in a standard tap wrench with an adjustable handle, two taps can be accommodated at one time. This is a very handy arrangement when a hole is to be rough and finish-tapped. By using the taper tap to rough out the hole, it is only necessary to reverse the tool to complete the hole, using the bottoming tap. The bushing or holder can be made of any good grade of steel.

¶Most drills are broken by unfair usage, such as crowding too hard before the drill has entered its full cut, or after the point has come through the work.

Blocks for Starting Taps Squarely

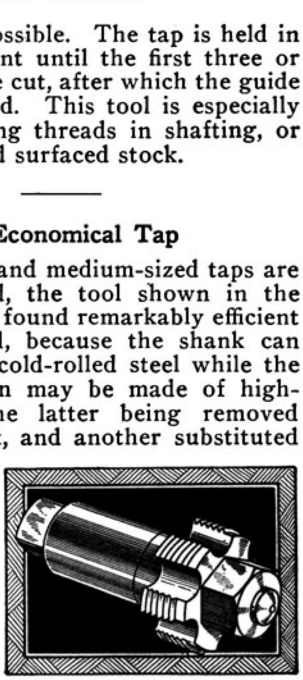
Cutting female threads is often difficult because of the tendency of the tap to make a bad start. By the use of a steel tap guide, as illustrated, faulty starting of the threading tool is impossible. The tap is held in correct alinement until the first three or four threads are cut, after which the guide may be removed. This tool is especially useful in tapping threads in shafting, or any other round surfaced stock.



If the First Few Threads Are Cut Properly the Others Follow Their Lead

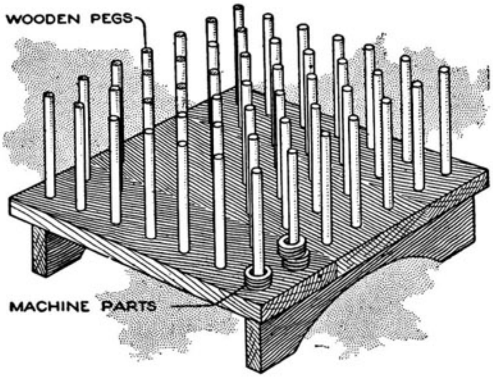
An Economical Tap

Where large and medium-sized taps are constantly used, the tool shown in the drawing will be found remarkably efficient and economical, because the shank can be made from cold-rolled steel while the working portion may be made of high-speed steel, the latter being removed when worn out, and another substituted without discarding the entire tap. An internal keyway in the shell engages with the key on the shank and prevents turning; a locknut underneath holds the shell to the shank. Another good feature of this tap is the semicircular shape of the flutes, which make the tap relieve itself of chips when being backed out, and prevents tearing of the finished thread.



Tray for Moving Small Threaded Parts without Injury

To truck small machine parts which are threaded both inside and out, without danger of damaging them, a carrying tray as illustrated is invaluable. The parts are slipped over soft wooden pegs which are so spaced over the surface of the tray as to prevent the parts from coming in contact with each other. Pegs should be of suitable length to hold 10 parts on each. This is a great aid in counting.



Small Threaded Machine Parts Are Handled without Danger of Injury and May Be Counted at a Glance

Making a Curved Hole in a Shaft

A certain piece of work called for a 1-in. shaft, 7 in. long, with a ⅜-in. hole in the center of it for about two-thirds of the way, then abruptly ending and opening out on the surface. The hole was made in the following manner: A 1⅛-in shaft was procured and bent at about one-third of its length, as shown in Fig. 1. A ⅜-in. hole was drilled through the center of the shaft so it would come out on the bend. The shaft was then heated and straightened out, after which it was turned down to 1 in. in diameter, as shown in Fig. 2.—Chas. Hattenberger, Buffalo, N. Y.

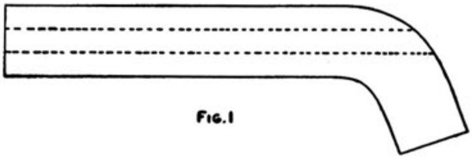


FIG. 1

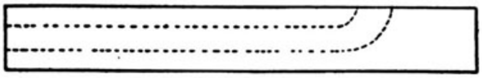
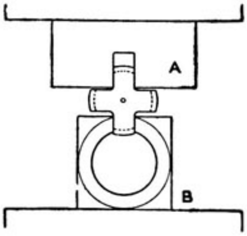


FIG. 2

Curved Hole in Shaft

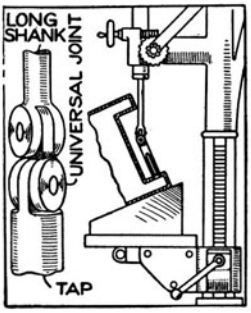
Cutting a Left-Hand Thread with a Right-Hand Tap

When it is necessary to cut a left-hand thread and no die is at hand, a very good thread can be made with a right-hand tap in the following manner: Cut a notch in a piece of metal to admit one of the flutes in the tap, as shown at A, then procure a blank nut that will receive the rod to be threaded snugly and cut a slot in one of its sides to admit the opposite flute, as shown at B. The threads on the flute should extend in the nut for their full depth. Slip the rod, or bolt, to be threaded in the nut the full depth, then draw the vise jaws together, to press the threads of the tap lightly into the metal, and turn the bolt to the left, at the same time giving it a slight downward pressure to start it in the proper pitch. After a few turns, the pressure is not necessary. The feed on the vise jaws is continued until a full thread is cut.—F. A. Dowler, Lawrence, Kans.

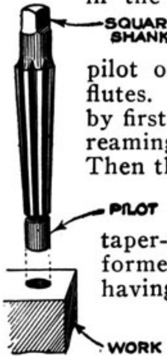


Universal Joint on Drills and Taps

Castings are frequently designed for holes under overhanging portions, which makes it impossible to do direct machine drilling in a drill press unless some special arrangement is provided. If the cutting tools are constructed with universal joints, as shown in the illustration, the drilling and tapping can be easily accomplished. One end of the joint is fastened to the tool and the other to an arbor. The arbor end is gripped in the chuck of a drill press. In drilling such a hole, it is best to provide a special guide block which can be clamped in position on the casting.



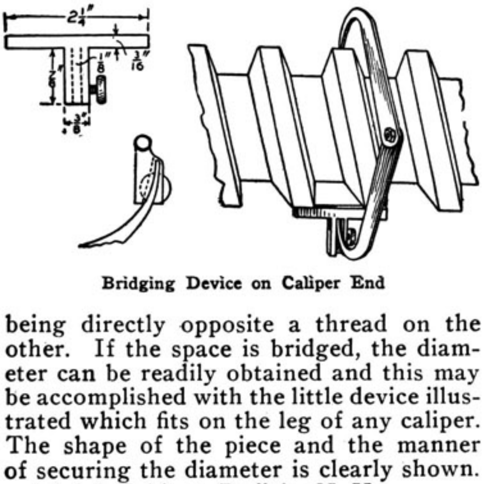
A Piloted Taper Reamer



Having to ream out a number of taper holes accurately, the taper reamer shown in the drawing was devised and used with satisfactory results, by grinding the pilot on the same centers as the flutes. The work was prepared by first drilling the hole and hand-reaming with a straight reamer. Then the pilot was lapped down to a close sliding fit in the hole, after which the taper-reaming operation was performed. The result was a job having the taper hole absolutely square and without chatter marks. Also, the time of production was reduced by about one-third.—W. Burr Bennett, Honesdale, Pa.

Calipering Large Threads

The ordinary caliper cannot be used to obtain the outside diameter over large threads, owing to the space on one side being directly opposite a thread on the other. If the space is bridged, the diameter can be readily obtained and this may be accomplished with the little device illustrated which fits on the leg of any caliper. The shape of the piece and the manner of securing the diameter is clearly shown. —Adolph Schiver, Buffalo, N. Y.

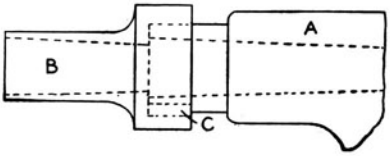


Bridging Device on Caliper End

An Auxiliary Drill Holder

It often happens that the taper hole in the spindle of a lathe is not a standard taper, so that the drill shank will not fit properly. This can be easily remedied by making an auxiliary drill holder to fit the end of the spindle and having a standard taper hole for the drill shanks.

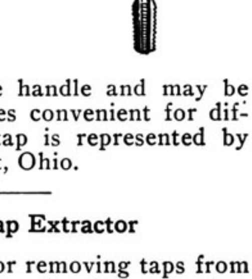
The end of the holder is bored out sufficiently to fit over the end of the spindle in A, and a key, C, the same width as the key in the spindle, is put into it. The key prevents the holder from turning around and the holder can be slipped off and on the end without any trouble. The taper B is the same as for standard taper-shank drills.—Chas. Homewood, Waterloo, Ia.



The Auxiliary Holder Is Fastened on the End of the Tailstock Spindle

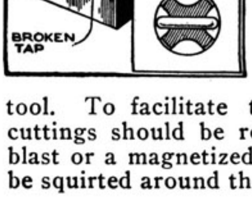
An Offset Tap Wrench

A single or double-handle offset tap wrench with socket is shown in the sketch. The handle, which is in two parts and represented by A A, can be separated and used with one side making a single-handle wrench, as is often required. The part B is a socket of suitable length for holding taps which are required for special work. This socket is fitted tightly in the handle and may be made in several sizes convenient for different taps. The tap is represented by C.—C. Purdy, Ghent, Ohio.



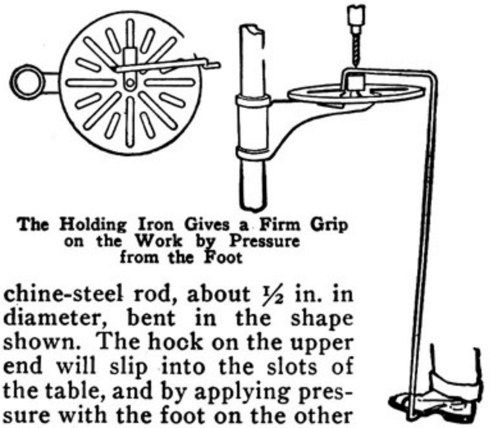
Broken-Tap Extractor

A simple device for removing taps from material in which they have been broken off is made by bending a piece of drill rod into a "U." The ends of the rod are placed in opposite flutes of the tap, and a monkey wrench, fitted on the projecting portion of the "U," is employed to turn the imbedded tool. To facilitate the operation, small cuttings should be removed with an air blast or a magnetized rod, and oil should be squirted around the tap.



Holding Work on a Drill-Press Table

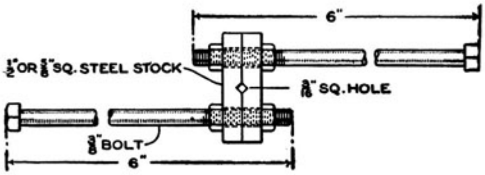
The device illustrated will hold small work firmly in position on a drill-press table for drilling. It consists of a machine-steel rod, about ½ in. in diameter, bent in the shape shown. The hook on the upper end will slip into the slots of the table, and by applying pressure with the foot on the other end, the work under the horizontal part will be held tightly in place, so that both hands are free to operate the table.—D. C. Goff, Knoxville, Tenn.



The Holding Iron Gives a Firm Grip on the Work by Pressure from the Foot

Tap and Reamer Wrench Quickly Made

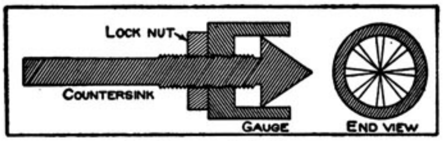
A wrench that is useful, especially with taps and reamers, was made quickly of two bolts, fitted with nuts, and two ½ by ½ by 2½-in. pieces of steel. The square stock was drilled for the bolts and filed to fit the square shank of the tap, or reamer. The bolts serve as handles, and the jaws can be adjusted to various sizes of small, square shanks. If desired, both handles can be set on one side for convenient use in close quarters.



A Simple Wrench That Can Be Quickly Made for Emergency Use; Also Practical as a Regular Tool

An Adjustable Gauge for a Countersink

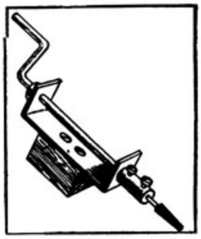
Countersinking holes to different depths for flat-headed screws in pieces varying in thickness makes it impossible to gauge the depth by the drill press spindle, or to do the work neatly with a hand drill. The sketch shows how to make a gauge on a countersink that will gauge the work perfectly, whether used with a hand drill or in a drill press. The gauge is in the form of a cup that can be adjusted by turning it on threads of the countersink. A lock nut is fitted to hold the gauge when set at the proper depth.



The Countersink Gauge

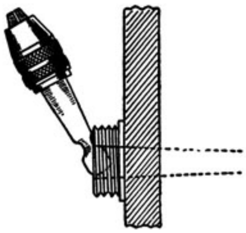
Homemade Tapping Machine

This machine is designed to be used for small taps which are too small for a large machine. The body is made from ⅛-in. sheet metal bent into the shape shown. A wood block can be fastened to the bottom with wood screws for holding the machine in a vise. The main shaft and crank consist of a ¼-in. rod bent to the proper shape. Chucks are made from short pieces of ½-in. rod drilled in one end to fit the main shaft and the other to fit the desired tap. Several chucks are necessary for the different-sized taps.



Removing Drill Chuck Quickly from Miller Spindle

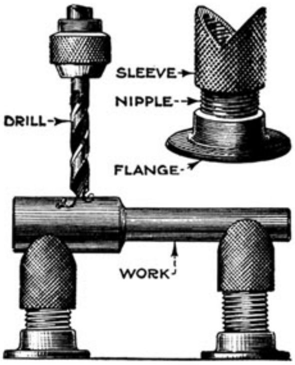
In the making of jigs and fixtures, it is often necessary to do drilling on the milling machine, and in so doing the chuck must be removed and replaced a number of times to substitute special boring or facing tools. After the work is properly located, it is very inconvenient to lower the table out of the way to drive out the drill chuck. If a part of the drill-chuck shank is cut off, and the end formed as shown, it will not be necessary to move the work out of the way, as the chuck can be taken out and replaced in a very small space.—Henry J. Marion, Pontiac, Mich.



Wood Preservatives

During the last 10 years it has been proved by tests performed by the U. S. Bureau of Agriculture that coal-tar creosotes are more effective in protecting wood against boring insects such as "white ants," and Lyctus-powder post beetles, than any other wood preservative known. Wood, impregnated with the creosote under considerable pressure, has been found to last for at least 25 years. The open-tank method of creosoting wood, if carefully done so that good penetration is obtained, will render the wood resistant for at least 15 years. On farms where it is impossible to use this method on the wood of buildings already erected, or on fence posts, the best method is to apply several coats of creosote with an ordinary paint brush or spray; this will add from 2 to 5 years to the life of the wood, providing it is not too old when the creosote is applied. By adding pigments to the oil a very neat and presentable appearance will be given to the wood.

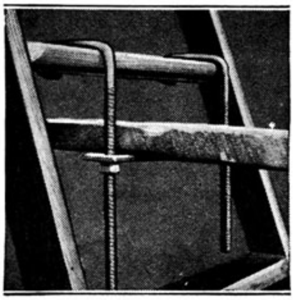
Adjustable V-Blocks from Pipe Fittings



One of the handiest sets of V-blocks for use on the drill press or milling machine can be made with a minimum of machine work, from standard pipe fittings. These blocks are adjustable for height, which makes them particularly serviceable when the work is to be supported at points having different diameters. The base of each block is made from a pipe flange, which needs no machining whatever. The standard is a short nipple screwed tightly into the flange. The "V" proper is made from a threaded sleeve or coupling, having a knurled outer surface. The 90° "V" can be cut out with a saw and finished by filing.

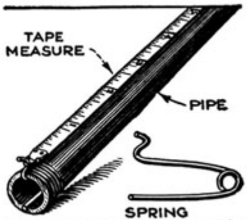
¶Two parts of tallow and one part of neat's-foot oil, melted together, make a good belt dressing. Apply once a month with a brush.

An Adjustable Scaffold



Painters and paperhangers often use a scaffold made by extending a plank between the steps of two stepladders. As the height of ceilings varies, the plank can be raised or lowered one or more steps to suit the worker, but the change of a foot in the height of the scaffold is often too much. For this reason the hooks shown in the photo will be found very convenient, as with their use, the scaffold can be raised or lowered to any desirable height. The hooks are made of ½-in. iron rod, bent as indicated, and threaded for almost their entire length. A 14-in. length of flat steel, ¼ in. thick and 2 in. long, is drilled at each end to fit loosely on the hooks, and nuts are screwed on, as shown, to hold the bar at any point. The hooks are hung on the steps and the plank is placed over the bars. Four hooks and two steel bars form a complete set.

Measuring Pipe with Tape



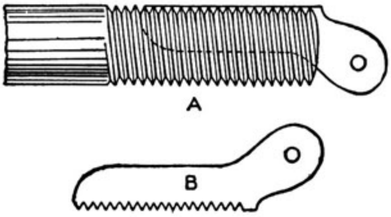
Pipe workers will appreciate the spring shown in the illustration as it greatly facilitates measuring long lengths of pipe, when the work is done by one man. A length of spring wire is bent to the shape shown, and is inserted in the end of the pipe so that the tape measure can be hooked onto it. The spring should be sufficiently strong to take care of pipe ranging from ½ in. to 1 in. in size.

Finger Grips for Gloves

When working outdoors during cold weather when it is necessary to wear gloves, it is rather troublesome to remove them in order to pick up small objects such as screws or nuts. This difficulty can easily be overcome by placing a small coin such as a dime or a penny inside of the glove, in the tips of the thumb and index finger, thus providing two flat surfaces between which a small object can readily be pinched or picked up.—Charles I. Reid, New York City.

How to Make a Screw-Pitch Gauge

Cut a clean thread with a new die on a bolt and make a slot through the center of the threaded length. Slip the piece of steel to be used for the gauge in the slot, as shown at A, and clamp it in a vise. It is an easy matter to file the threads into the gauge with a new three-cornered file. The metal is then shaped as shown at B. A set of gauges can be made in this manner and attached to a handle. The number of the thread should be stamped or etched on the gauge.—Louis A. Novak, Mahnomen, Minn.



The Threads on the Bolt Make a Guide for Filing the Notches on the Gauge

A Soldering Kink

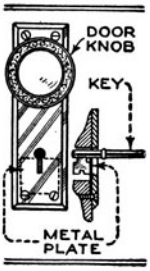
It frequently happens that solder cannot be made to cover a large hole in a utensil. This difficulty can be prevented by holding a piece of cloth, folded to make a thick wad, under the hole, and unless the hole is entirely too large the solder can then be made to cover it. A very large hole can be closed by reaming it out, cutting a disk of tin to fit, and soldering this disk over the hole. The surface to be soldered should always be perfectly clean, and it is a good idea to use a file on it to roughen it slightly. Plenty of flux should be used to make the solder unite the parts firmly. —Louis Schneider, Clinton Mo.

Nickel-Plate Preserver

An excellent preservative for nickel exposed to the weather, such as the plated parts on automobiles, can be made from ½ oz. of camphor gum, 1 oz. of powdered graphite, and 2 oz. of mutton tallow. The camphor gum is cut to fine shavings and added to the heated mutton tallow, and both are thoroughly mixed. Allow the mixture to cool until lukewarm and then add the graphite. Stir until it assumes the consistency of a thick paste. By using it once or twice a month the nickel parts will never corrode, but will always look bright. —Mrs. A. K. Hinkley, Rowley, Mass.

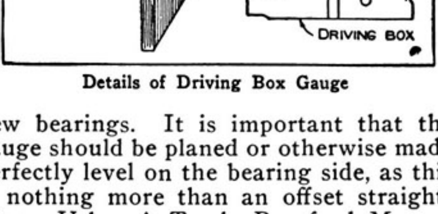
Keeping Keys in Door Locks

Many door keys have a tendency to drop out of the locks frequently, which is very annoying, especially when the door is in constant use, and every slight jar causes the key to fall out. It is, however, a simple matter to prevent this trouble by inserting a small metal plate under the lockplate as indicated in the drawing. The space that this plate should occupy is shown by the dotted lines; it should be as long as the width of the lockplate and wide enough to extend from the shank of the key, when inserted in the lock, to the lower screws holding the lockplate in position. The object is to close the slot through which the key is inserted. Obviously, this device is an excellent burglar protection as the key cannot be pushed out of the lock from the other side.—J. E. Decker, Chicago, Ill.



How to Make a Driving Box Gauge

The accompanying sketch shows a gauge for transferring the line where the driving box shoe bears on the outside of the box for the purpose of centering the brass which is necessary when boring worn or new bearings. It is important that the gauge should be planed or otherwise made perfectly level on the bearing side, as this is nothing more than an offset straightedge.—Urban A. Towle, Rumford, Me.



Details of Driving Box Gauge

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How To Make Money at Home

You have the ability to make something that can be sold to your neighbors and friends. But, what is it, and how may you learn the best method of making it? This page will help you answer these questions and will also help you to embark on a little business of your own, starting in your own home.

Following is a suggested library in which you will find hundreds, yes, thousands of articles described that may be made at home and sold at a nice profit. These articles are suitable for men, women, or children, and are bought by all classes. This library will first aid you in selecting articles that you will enjoy making and selling. Then it will tell you just exactly how to make those articles. And after they are made, you can study the "Salesman's Handbook" and learn how to sell them.

Many a Profitable Business Has Been Started on a "Shoestring"

You have read dozens of stories telling how some nationally-known business was started in somebody's attic, or in "an old shed back of the house." Most of these stories tell of how an individual started making a product that was in general demand and soon found it necessary to build a big factory.

There is still the same opportunity that was seized by the men who are our leading manufacturers today. And the method they used in starting is still the safest way to start. There have been more failures of men who first built a factory and then tried to develop the trade than of men who did their own manufacturing and their own selling until their trade forced them to build a factory.

Make Money on the Side

All this is well to consider, but there is opportunity to make side money even if you never expect to own a factory. And the books here recommended are the very ones you need to make your ambition grow into reality.

Popular Mechanics Money-Making Library

1. Henley's Twentieth Century Home and Workshop Formulas, Recipes and Processes. This book contains 10,000 formulas and recipes for making useful articles such as:

Perfumes
Flypaper
Ink
Washing fluids
Glue
Paste
Soap, including liquid soap
Foot powder
Insect powder
Fire works
Silverware cleaner
Mucilage
Dyes
Hectograph pads
Blueing
Rat poison
China cement
Cosmetics of all kinds

and thousands of other equally salable articles.

2. Amateur Furniture-Maker's Library. This library consists of seven handy cloth-bound volumes, as follows:

Wood-working for Amateur Craftsmen
Mission Furniture, How To Make It, Part 1
Mission Furniture, How To Make It, Part 2
Mission Furniture, How To Make It, Part 3
Rustic Carpentry
Arts-Crafts Lamps
Lamps and Shades in Metal and Art Glass

Whether you have had any experience in carpentry or not, this library should enable you to become proficient in making articles of furniture for sale to your neighbors. It begins right at the beginning and tells you how to order lumber, and how to use and care for the different tools.

3. Metal Work and Etching. This book tells how to make decorative and useful articles from metal. From it you may learn how to make such articles as:

Book ends
Paper Knives
Desk Calendars
Pipe racks
Jewelry
Hinges
Bookmarks
Desk sets
Stationery racks
Match boxes
Whisk broom holders
Hatpins
Drawer pulls
Brass plaques
Blotting pad corners
Rocking blotters
Tie racks
Candle sconce
Desk clocks
Watch fobs

4. Electroplating. This book tells how to plate metal articles with copper, nickle, silver or gold. Thousands of homes have worn plated ware that should be replated. You ought to be able to build up a nice business right in your own neighborhood. One satisfied customer will tell another, and you should soon be so busy that your sideline may become a principal source of income.

5. The Salesman's Handbook. Here is the book that will tell you how to become a good salesman of your own products. From it you will find it easy to learn the principles of salesmanship. It will also enable you to be more accurate in figuring the selling prices of the articles you have to sell.

If you have an inclination to sell by mail, you can learn how to do that in this valuable book. Many have found that they can build up a much larger business by selling through the mails, and so this feature is unusually valuable.

Will You Seize This Opportunity To Make Money?

It is a real opportunity. Probably you have never before been offered such help as you are offered here. No doubt you have been wishing for this very help. You can "cash in" on it if you will order **Popular Mechanics Money-Making Library** for

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Make Your Own Furniture and Decorative Articles

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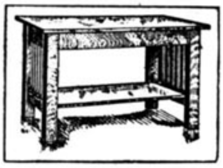
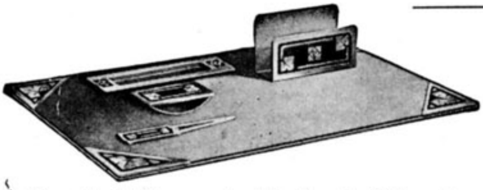
Amateur Furniture-maker's Library

This library tells exactly how to make practically all of the furniture you might need about a home. It also includes instructions for making outdoor rustic furniture and decorative lamps and shades. The library is made up of seven cloth-bound, pocket-size books as follows:

1. **Wood-working for Amateur Craftsmen.**
2. **Mission Furniture, How to Make It, Part 1.**
3. **Mission Furniture, How to Make It, Part 2.**
4. **Mission Furniture, How to Make It, Part 3.**
5. **Rustic Carpentry.**
6. **Arts-Crafts Lamps.**
7. **Lamps and Shades in Metal and Art Glass.**

These books include instructions on selecting material and tools as well as plans for making 235 articles. Anyone at all handy with tools should be able to make any of these articles and have a lot of fun doing it. If the books were bought separately, they would come to $3.50. The price of this complete **Amateur Furniture-maker's Library** is **$3.15**





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Decorative Metal-worker's Library

1. **Metal Work and Etching**
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